The Chemical Age. 29 April 1950
LABORATORY FURNISHING AND SCIENTIFIC INSTRUMENT NUMBER

The Chemical Age

VOL LXII 29 APRIL 1950 No 1607

INDEX TO ADVERTISERS IN THIS ISSUE

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LAURYL SULPHATE

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Chemical Nature :

Triethanolamine Lauryl Sulphate

Active Matter and Composition :

Active matter, 45/47%
Unsulphated Alcohol, 2/3%
Water, 50%

Appearance :

A medium viscous, clear amber liquid

Packing :

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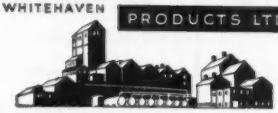

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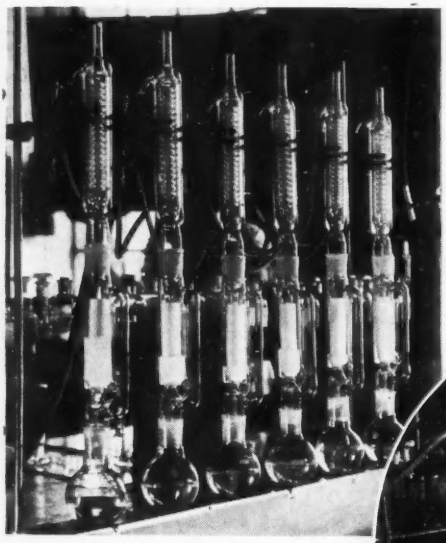

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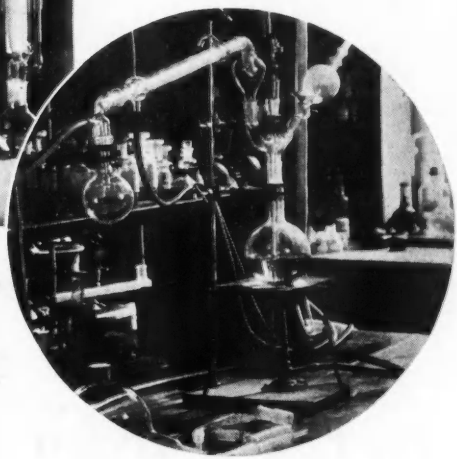

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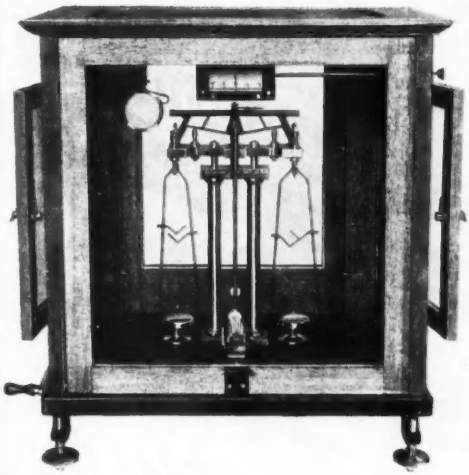

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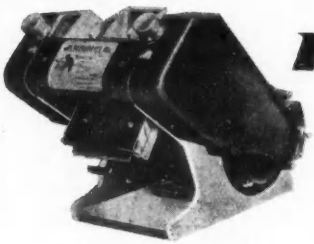

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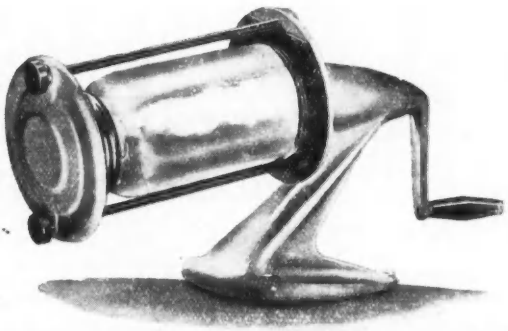

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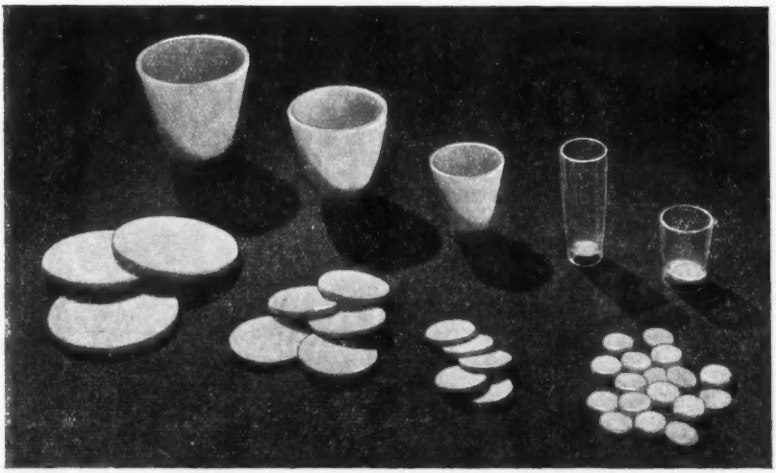

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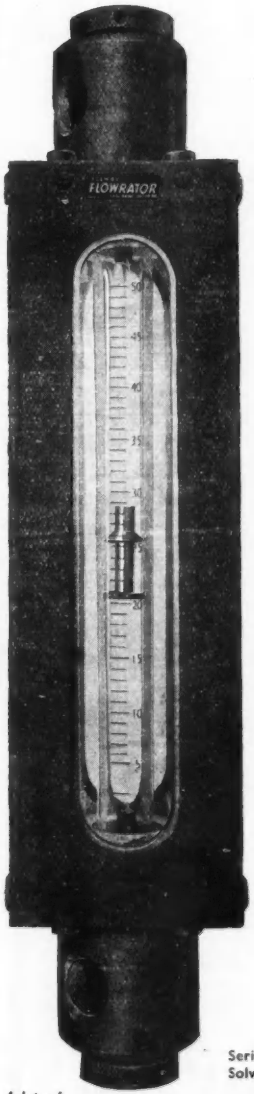

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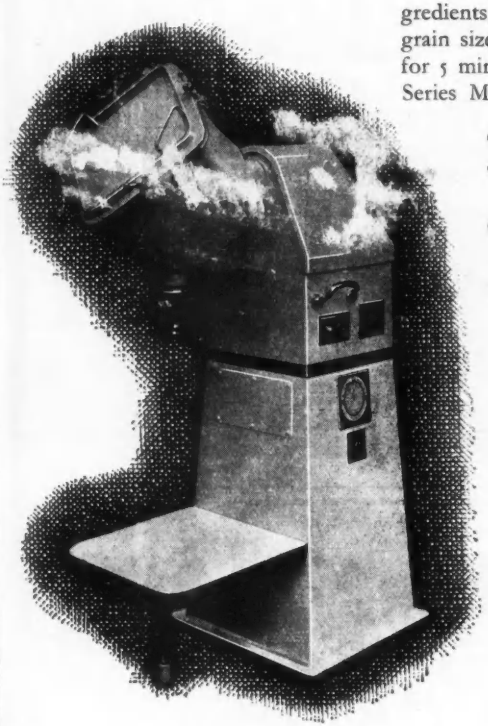

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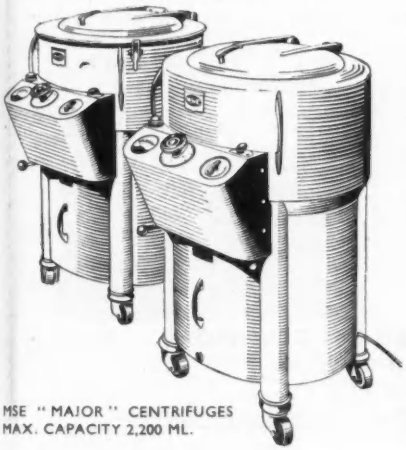

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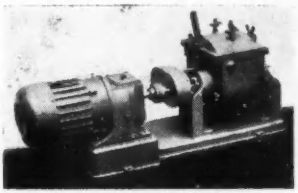

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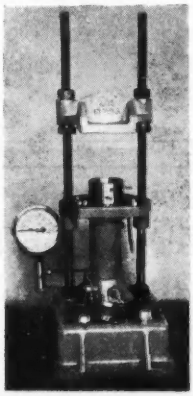

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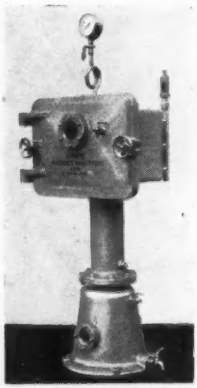

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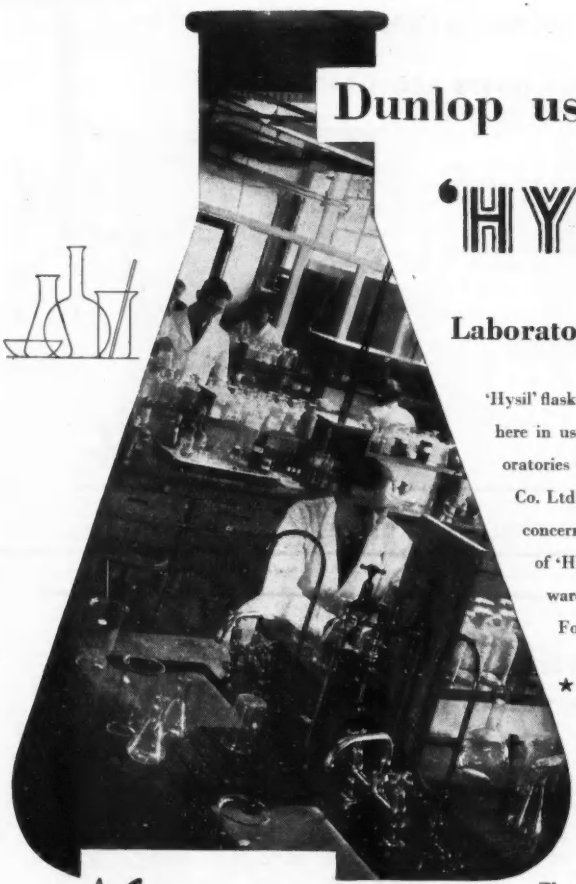

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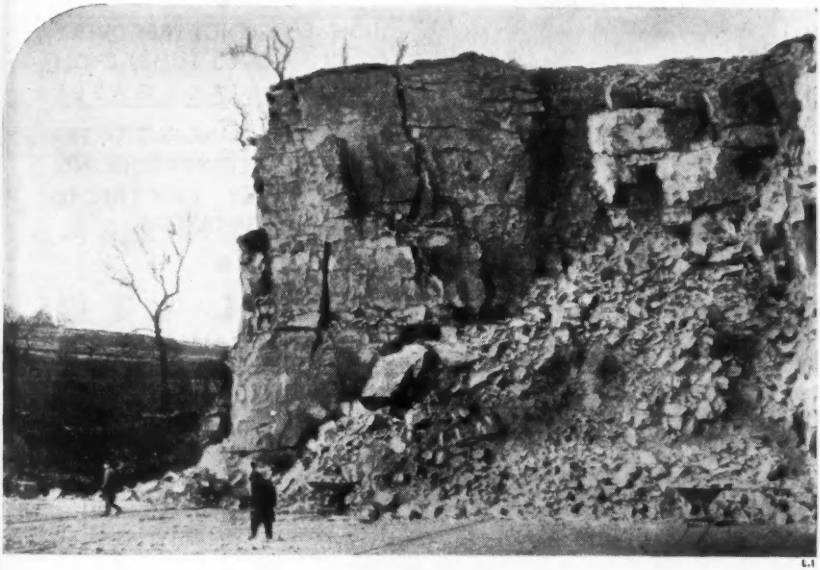

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The Weekly Journal of Chemical Engineering and Industrial Chemistry

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Volume LXII 29 April 1950 Number 1607

A Vigorous Instruments Industry

THE scientific intsruments which Britain is making to-day represent what is probably the most promising sector of industrial output. It is not often that such a claim can be advanced with confidence in the unstable conditions of material supplies and changes in the balance of world trade and industry. In instrument production, however, British laboratories and workshops now hold a position, butressed by a host of intangible assets, which virtually ensures that whatever the future may hold, short of industrial stagnation, their contribution and rewards will consistently increase. The industries concerned are fortunate in being able to meet that promising phase better equipped with talent, experience and physical resources than almost any others.

Because the advancement of science has at all times depended upon the increasing improvement in the methods of measurement there has been an enduring and intimate community of interests between scientists of all kinds and those who made their instruments. Both branches have a common parentage derived from the pioneers in the sciences, who were accustomed to fabricate for themselves the instruments required to transmute their ideas into demonstrable form. The keynote to-day of the policy of the instrument makers is still the close collaboration with all the main fields of scientific research. Most of the work which now comes from the laboratories and drawing offices of the instrument makers thus shows an intimate understanding of the immediate needs of the research laboratories and of the larger demand which industries will make soon after. In that privileged position there is small danger that effort will be wasted in the production of goods for which the demand is waning.

Instrument making, in common with chemistry, has emerged from the war with a great accretion of strength, in spite of the fact that, like most chemistry departments, it had been obliged to concentrate all its forces into the channels dictated by defence needs. Whether it is true or not that the last conflict was in fact a "push button war," the fact that instruments were used on an unparalleled scale in every branch of the Services is beyond all doubt. Instruments and armaments were for a time virtually synonymous terms. Now that the unwelcome association has largely been ended by more creative objectives the very large expansion of productive capacity has

On Other Pages

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left a legacy of which the industry is very well equipped to make full use. This is in effect "a second chance," for some such stimulus was given once before when the first world war established the importance of the scientific and technological departments. The scale of that impetus, however, does not bear comparison with the extraordinary advancement of science applications during 1939-45, and much of the advantage which was first conferred was dissipated during the period of industrial recession and uncertainty which characterised the 1920's.

The different situation to-day is founded in part on two exceptional factors, the fundamental changes brought about in the wartime development of electronics and atomic physics and the alacrity with which the faculties are being adapted for industries. Of these, electronic principles, had the great advantage of possessing an ample background of science and some technology before war enforced the rapid advance of the latter. Most of the veils of official secrecy were fairly quickly swept away when war ended. The resultant penetration of electronic principles into the laboratories and production centres has led to a concentration of effort which some regard as excessive. That conclusion was capable of being drawn from a superficial impression of the last exhibition of the Physical Society and some earlier corporate instrument displays.

The view, however, possibly overlooks a new factor affecting electronics and, to an increasing degree, the by-products of nuclear fission—which are the subject of an authoritative review in this issue. Neither of these scientific tools belongs any longer exclusively to the research laboratories. The widening scope of instrumentation in industry is a development which the war greatly intensified. Electronic controls and the growing use of radioactive isotopes will not fail to require the production for industries of new categories of "utility" models of the laboratories' more versatile equipment. The substantial changes in production procedure must afford British instrument makers opportunities to serve a field larger than they have ever entered. That it need not be confined to these islands is suggested by the wholehearted participation by the Scientific Instrument Manufacturers' Association in the Canadian international trade fair in May.

Notes and Comments

Upward Trend of Exports

THOSE who look for omens on the eve of the BIF may find all they want in the official records of March export trade in chemical materials. For them the sharp revival of overseas sales represented by the overall figure of £8,274,000—£703,000 more than in February—may appear as conclusive evidence that the small setback in the export market in recent months has been overcome. That is most probably true, although there is no certainty that the beneficial effects will be shared by the BIF, which from the chemical manufacturer's point of view is much less important as an occasion for securing contracts than as a unique opportunity for meeting the representatives of counterpart and user industries. In either case the recording of substantial export increases in all the categories contributing to the enlarged total, of which industrial chemicals alone contributed over £4,518,000-£566,000 more than in February—will not fail to have effect as propaganda for British chemical materials. The result was helped considerably by the very much more ample trade being done with the South American countries and Scandinavia. These are opportune compensations for the great reduction of chemical trade with India, of which the first quarter's totals in 1949 and 1950 show a reduction of 75 per cent this year. The reduction or stoppage of some of these essential supplies is now being criticised by chemical processes industries for having severely limited industrial development in India.

Tracers and Industry

APPLICATION of radioactive tracer element technique in production and research in industry is still in its infancy. That confers a special interest on the facts that have been obtained by a questionnaire sent out earlier this year by a Surrey firm in an attempt to gauge the extent of interest if expert guidance were made available in the factories. Of 150 firms which replied to express their readiness to take advantage of this promising technique, the largest proportion—23—were engineers, followed by chemicals, which were integrated with metallurgical and food, each with 14. Textiles came next with 10, while among the remainder were: electrical engineering and paper 7 each; ceramics 6, rubber and plastics 6, with leather, paint and instruments 5 each. It was noted, however, that 18 firms had already opened or planned to open their own tracer laboratories. Excluding libraries, universities, journals and chambers of commerce, over 8000 sets of literature were sent out by Mactaggart & Evans, Ltd. These included 150 chemical consultants, 50 research associations, and 1350 chemical manufacturers in Denmark, Norway, Sweden and Holland. Replies from British firms (excluding research associations, consultants and Government departments) showed that 151 were interested, 505 were not.

Assessing German Achievement

THE final assessments of German technology during 1939-45, of which the latest review of paint industries (BOIS Survey 22) may be nearly the last to be published here, have usually moderated some popular beliefs about phenomenal achievement of applied science behind the German war fronts. No one will assail the reputation due to the great advances which some Germans made in chemical synthesis and such things as the Fischer-Tropsch and high-pressure acetylene sources. That creative and imaginative spirit was very far from being uniform. The paint industry survey is not the first to note that the use made in Germany of new or unconventional materials and processes was much below the quality of the research effort. It is put on record now that the German paint scientist and technologist seemed individually to be less curious and

research-minded than his British counterpart. Raw materials were often used without knowledge of their composition. This survey, which most usefully collates the sectional reports which have already appeared, serves, however, to underline the very important advances in Germany providing new sources of urethane oils and polyurethane resins, synthetic resins and resinous materials.

German Coal and Chemicals

THE repeated appearance of accounts of rapid industrial recovery in the western zones of Germany leave no doubt at all of the existence of a determination to recapture the position in world commerce of which the bid to dominate the world deprived her. These industrial stories are evidently authentic, even if an element of propaganda colours the selection of material for publication outside Germany. They deserve to be studied closely by those who pontificate about economic and industrial possibilities in places where wartime destruction is no longer a serious impediment to full production. Allied technicians accompanying the armies in 1945 found the Aachen and Ruhr coalfields temporarily or permamently bereft of some 35 per cent of surface installations, chiefly as a result of bombing attack, and flooding and general disorganisation characterised the whole. In less than five years production has been raised from a trickle of some 30,000 metric tons of hard coal daily to about 360,000 tons, only 88,000 tons short of the record achieved when Germany was pressing on her plans for war. Some of the credit must go to the Allied commissions, whose confident prediction that they can secure the raising of 400,000 metric tons daily by November next might make a curious contrast with the more tentative policies of the National Coal Board—if such a comparison could fairly be drawn. Incentive schemes employed by the Coal Commission in North Germany, including 44 per cent wage increases, appear to have produced almost automatically the desired result. The temptation to draw parallels between an effort which was required to stave off national dissolution and the less obviously urgent tasks in post-war Britain has to be resisted. But as an earnest of the increasing industrial force with which industries will have to compete in the Western markets the recent records of the German coal and chemical industries leave room for no half measures here.

Packaging

INTELLIGENT packaging has become, since the war, one of the bigger preoccupations of chemical industries, from two standpoints. Besides forming an essential study for the dispatch departments, packaging accounts for an important new branch of chemical technology concerned with the provision of a number of surprisingly effective new materials. What is not generally realised is the debt which the present technology owes to wartime investigations by the Army. The Forces (principally the RAOC) started a small revolution in packaging technique, employing as "shock troops" a select band of experts assembled by Major-General Sir Leslie Williams, who last week recalled, in London, the initiation of that campaign. He was speaking to the Institute of Packaging, which has inherited and notably advanced what was started in the ordnance depots, and recalled how the inadequacy of the early Army packaging jobs was revealed by the receipt of smashed consignments in the theatres of war. That was the subject of one of the legitimate complaints by Stalin—to Mr. Churchill. Mr. John Evan Cook, the new chairman of the Institute of Packaging, was one of the experts which the Army called in to tour the country and preach the new doctrine of packaging war supplies. He pursues the same mission now, to a different audience. The mission's growing success is reflected in the intention of industry to rectify such matters is apparent from the institute's membership; it has increased by some 40 per cent during the term of office of Mr. G. M. Ashwell, packaging adviser to I.C.I., Ltd., the retiring president.

CONCERTING INDUSTRIAL POLICY

FBI President on Prospects for Producers

SOME of the more urgent problems confronting industries were surveyed by Sir Robert Sinclair, member of the Dollar Exports Board, in his address after his re-election as president of the Federation of British Industries, in London last week.

The virility of productive industry had been strikingly emphasised during the past year, said Sir Robert, not only by an appreciable increase in total production but also by considerable improvement in our position as regards dollar balances. There were good grounds for hopefulness.

" But," he continued, " let me say, with all the emphasis that I can command, that, unless there is a substantial reduction in Government expenditure soon (so as to make possible reductions not only in corporate taxation but in general taxation as well), we are not going to make the best of the recuperative power that is in us.

" Past or present achievements, whether of increased total production or of higher productivity, do not vitiate this argument. The incidence of taxation on industrial companies has had the result not only of forcing them to live on capital, but also of preventing the adequate provision for future needs on which our future performance must depend. The increase in initial allowances for replaced capital will help: but this is at best an anticipation of allowances that we should in any event receive. It is no substitute for the reduction in Government expenditure."

No More Nationalisation?

Other points from the president's address were these:—

We trust (he said) that one result of the recent General Election will be at least indefinite postponement of further proposals of nationalisation. And we profoundly hope that, in the interests of united national effort wiser counsels will prevail to prevent the nationalisation of iron and steel getting under weigh next October. The industry itself continues month by month to give truly remarkable proof of its virility and its enterprise under the existing conditions.

The hard facts of our present situation are exemplified in what our money will buy today. To replace our machinery costs us two and a half to three times what we paid for the old; and the cost of financing our raw material purchases has in general been heavily increased, the more so since sterling was devalued.

Meanwhile, taxation is eating into our savings, corporate and private. Industry is undoubtedly threatened with a depletion of capital which, unless corrected, must make expansion difficult and even prejudice the maintenance of current production.

Without the continual replenishment of our industrial capital we cannot maintain that efficiency which is essential if we are successfully to meet world competition.

Productive industry is the life blood of our economy. Are we to jeopardise our future for the sake of a temporary well-being which must collapse if the foundations on which it is built are undermined?

No one wants to see the social services cut. No one wants to see our standards of living reduced. But we must live within our means.

Essential Economies

As I see it, a substantial reduction in Government expenditure and some lightening of the load of taxation is urgently necessary if the drain on capital is to cease.

The problem presented by the dollar gap is formidable. Its solution must be sought through many channels, and it is clear that even if the trading prospects with Canada are, as I believe, distinctly promising, we cannot expect any quick increase in direct U.K.-U.S. trade sufficient in itself to pay for what we must have from U.S.A. Yet I have no doubt that we are going to increase our dollar sales.

The Canadians, and the present administration in the United States, are sympathetic and will give us all the help they can. But a supreme effort is needed from our manufacturers and merchants if we are to make the most of our opportunities. The Dollar Exports Board is proving it can give valuable help.

The FBI president urged that there were opportunities for even wider service by trade associations in concerted activities in trade regulation and export promotion. The meetings now being held in various parts of the country under the auspices of the Dollar Exports Board, assisted by the FBI, should, he thought, clarify the opportunities and help to pave the way for action.

INCREASED CHEMICAL EXPORTS

March Totals Again Over £8m.

EXPORTS of chemicals in the first quarter of this year reached a total of £23,031,824 compared with £22,520,067 for the first three months of 1949, the value of chemical manufactures (excluding drugs and dyestuffs) showing an increase of nearly £1 million.

Totals for March also showed a marked improvement, the value of exports being £8,274,390 compared with £6,851,945 in February and £7,571,228 in March, 1949.

Imports for the first three months of this year of chemicals, drugs, dyes, and colours were valued at £8,660,086 an increase of £1,810,134 over the totals for the first quarter of 1949.

EXPORTS

	March, 1950	March, 1949
	Gal.	Gal.
Cresylic acid	142,285	78,794
	Lb.	Lb.
Salicylic acid and salicylates ...	124,319	186,440
Value of all other sorts of acid ...	£191,719	£105,681
	Tons	Tons
Sulphate of alumina	2,525	2,975
All other sorts of aluminium compounds	2,312	2,398
Ammonium sulphate	14,150	9,123
Ammonium nitrate	4,051	7,632
All other sorts of ammonium compounds	1,955	1,274
	Cwt.	Cwt.
Bleaching powder	14,984	41,219
All other bleaching materials ...	11,706	9,648
Collodion cotton	2,691	1,831
	Tons	Tons
Copper sulphate	7,831	3,341
	Cwt.	Cwt.
Disinfectants, insecticides, etc. ...	36,936	49,157
	Tons	Tons
Fertilisers	3,491	2,143
Value of gases (compressed, liquefied or solid)	£27,211	£19,042
	Cwt.	Cwt.
Lead acetate, litharge, red lead, etc.	9,134	7,292
	Gal.	Gal.
Tetra-ethyl lead	95,473	120,348
	Tons	Tons
Magnesium compounds	860	629
	Cwt.	Cwt.
Nickel salts	6,473	4,515
Potassium compounds	6,446	6,000
	Tons	Tons
Salt	15,472	17,781
	Cwt.	Cwt.
Sodium carbonate	336,214	383,905
Caustic soda	232,067	126,383
Sodium silicate	24,466	33,931
Sodium sulphate	3,477	16,430
All other sodium compounds ...	86,900	79,191
	Gal.	Gal.
Tar oil, creosote oil, anthracene oil, etc.	3,952,799	4,103,741
	Tons	Tons
Zinc oxide	1,250	1,337
Total value of chemical manufactures (excluding drugs and dyestuffs)	£4,518,701	£3,952,331
	Lb.	Lb.
Acetyl-salicylic acid	154,904	141,031
	100 International Units	100 International Units
Insulin	1,144,148	752,611
	Mega Units	Mega Units
Penicillin	870,405	449,625
Total value of drugs, medicines and preparations	£1,726,491	£1,678,753
Total value of dyes and dyestuffs ...	£963,533	£807,531
Total value of paints, pigments, colours, etc.	£1,065,665	£1,132,613
	Cwt.	Cwt.
Plastic materials	53,400	34,477
Value	£709,730	£425,048
	Cwt.	Cwt.
Chemical glassware	1,421	1,238
Value	£55,151	£46,366
	Cwt.	Cwt.
Fans	3,964	4,978
Value	£115,167	£149,137
	Cwt.	Cwt.
Furnace plant	7,224	7,175
Value	£74,082	£95,236
	Cwt.	Cwt.
Gas and chemical machinery ...	26,989	26,299
Value	£358,101	£323,923
Optical instruments, **value** ...	£71,203	£91,698
Thermometers, mercury in glass instruments, etc., **value** ...	£42,713	£35,010

IMPORTS

	March 1950	March 1949
	Cwt.	Cwt.
Acetic anhydride	12,554	3,473
Acetic acid	—	—
Boric acid	12,500	8,300
Carbolic acid	1,968	—
Value of all other sorts of acid ...	£53,432	£59,797
	Cwt.	Cwt.
Borax	28,601	30,041
Calcium carbide	100	2,188
Cobalt oxides	357	448
	Tons	Tons
Fertilisers	30,049	35,894
	Lb.	Lb.
Glycol ethers and glycol ether esters	685,495	673,907
Iodine	132,256	132,126
	Cwt.	Cwt.
Potassium chloride	601,110	401,441
Potassium sulphate	21,940	55,364
All other potassium compounds ...	17,591	4,003
Sodium nitrate	—	181,342
All other sodium compounds ...	9,481	2,770
Carbon blacks (from natural gas)	69,345	39,848
Value of carbon blacks	£295,199	£130,771
Total value of chemicals, drugs, dyes and colours	£3,418,085	£2,467,393
	Tons	Tons
Sulphur	38,650	34,845
Value	£371,496	£286,729
	Cwt.	Cwt.
Gas and chemical machinery ...	6,697	185
Value	£159,957	£8,919

LIGHT OILS TAX

FBI Support for Opposition

A LETTER, supporting the protests of a number of industries that make use in their processes of light hydrocarbon oils, has been addressed by the Federation of British Industries to the Chancellor of the Exchequer. It observes that the additional 9d. applies for the first time to indigenous oils and represents a very large increase in the rate of duty on imported oils. There would therefore be both a wider field of manufacturers affected and a much higher rate of duty on those who have used imported oils. It was hoped the Chancellor would reconsider the decision. The letter recalls the concession promised in respect of agricultural vehicles or machines using taxed fuel. The federation considered that the industries using these oils in their processes of manufacture had at least an equal claim for relief in view of the necessity to keep down costs.

Higher Transport Costs

A further letter, stressing the serious effects of increased transport costs has been sent to the Chancellor on behalf of the FBI, the Association of British Chambers of Commerce, and the National Union of Manufacturers. It says, in part, "Our respective organisations desire to lay before you the very strong objection which they take to the proposals in your Budget affecting road transport. These proposals inevitably increase costs at a time when the necessity to curb all inflationary pressures is paramount, a point which you yourself have lost no opportunity of stressing."

Copper Buying

THE Minister of Supply was asked in the House of Commons by Mr. John Grimston why he had increased the price of copper by £9 per ton when the price he had to pay was only increased by £8 per ton. It was also asked whether, as this involved a further increase in cost for export industry wholly due to the policy of bulk buying, the Minister would re-examine the possibility of returning the buying of copper to private hands. To the latter part of the question Mr. J. Freeman replied that the matter would be re-examined if it could be shown how the return of copper buying to private hands could be effected without the loss of sterling copper to the U.K. manufacturing industries.

DISSIPATING THE ASSETS

Sir Ernest Benn on Current Policy

A WARNING that there was nothing very pleasant about what he was going to say—he was going to talk about the Budget—was given by Sir Ernest Benn, speaking at the 94th Individualist luncheon in London last week. This was Sir Ernest's first public engagement, marking his recovery from a recent illness, and he spoke of his delight in getting back to his accustomed activities.

Inconsistent

In the course of a forthright attack on the economic and industrial conditions created by the Budget proposals and previous Government policy Sir Ernest deplored the vitiation of moral and physical stamina in the nation by Sir Stafford Cripps' apparent design to create "a nation of Christian paupers." Sir Stafford Cripps's inconsistencies were calculated, Sir Ernest implied, to destroy any confidence in his policy. Having contraverted all his earlier assurances that the £ would not be devalued, the Chancellor had said, after the £ had been devalued, he would not tolerate any businessmen taking advantage of the situation. Now he had warned that we had not yet experienced the full effect of the rise in prices which must follow devaluation. Yet he saw no reason why the higher price of petrol should affect the cost of transport. Meanwhile, British Railways were losing half a million pounds a week.

Because of penal death duties, the country was littered with costly capital assets. Such property represented a national capital loss on an appalling scale.

All the legislation of the last year had been designed quite bare-facedly to carry on the good work of creating a new social system and destroying capitalism. "Is it not reasonable to suggest," asked Sir Ernest, "that if, in due course, we do get a new Government, they should, on the advent of national collapse, call Parliament together and put through a few Acts wiping out some of these things which have happened in the last five years?"

These five years had been spent in trying to get over four popular slogans—full employment, security, fair shares, and equality of sacrifice. Full employment, in plain English meant unrequited wages, and in many cases double money for half work, and in the case of the building industry treble money and no questions asked about the amount of work done.

ELECTROCHEMISTRY IN INDIA

Important Pioneer Work in Prospect

THE great potential value of electrochemical processes to industry and the achievements in that field of the U.S.A. were reviewed at the recent opening in Bangalore of an India section of the Electrochemical Society of America. It was the first occasion in the society's 50 years of existence that a foreign section had been founded outside the United States.

Dr. B. K. Ram Prasad, electrical engineer to the Government of Bombay, who was elected the first president of the society, referred to the pioneering work in Mysore, where the alkali, ferroalloy and other industries were established about 25 years ago.

Cheap Electric Power

Electrochemical processes, said Dr. Ram Prasad, could be of considerable help in finding substitutes for the coal and vital metals, such as copper and nickel, which India lacked.

The Government of India was planning to start river valley schemes which would give cheap electric power to industries. A definite quota of power for electrochemical industries should be allocated, he said.

Nearly 10 years ago an electrochemical industries panel had been set up by the Government and this was followed by the decision to establish the Electrochemical Research Institute at Karaikudi, South India. The building was expected soon to be in operation.

The president stated in conclusion that the India section would have an important rôle in advising industries, fostering research and furthering education in electrochemistry.

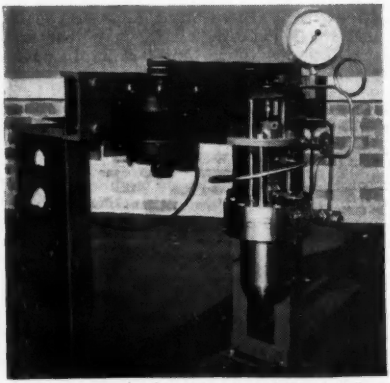
Dr. Gilbert J. Fowler, secretary of the Indian Section of the Royal Institute of Chemistry, wished success to the venture.

A Stable Savings System

MR. JOHN BENN, presiding on April 19 over the annual meeting of the United Kingdom Provident Institution for the first time since his election as chairman, said that insurance, in common with several industries, had been impelled to find its voice by the threat of nationalisation. The institution played its part in the Life Offices' campaign to defeat this reckless proposal.

The nation had learned that its life assurance savings now amounted to at least £2,000 million, an average of some £40 per head of the population. Moreover, as these savings were being maintained and increased at a time when most other forms of thrift had halted or gone back, the Chancellor of the Exchequer would do well to improve the amount of tax relief on life assurance premiums.

Laboratory Constructs Its Own Autoclave



[Courtesy of *The Autoclave*

This stainless steel high pressure autoclave was constructed in the Nickell laboratories of Monsanto Chemicals, Ltd., to supply an urgent need at short notice. A solid 10 *in. cube of stainless steel, weighing approximately* 2½ *cwt. was employed for the body, and a corresponding billet* 8 *in. thick for the cover. Work was begun in July,* 1949, *and completed in February,* 1950, *seven months later. The only items purchased are stated to have been the pressure gauges, electrical components and control valves. Dimensions of the finished autoclave were: external diameter of body* 5½ *in.; internal diameter of body* 4 *in.; diameter of cover* 8¾ *in.; overall height (excluding fittings):* 10 *in.*

NEW TRENDS IN INSTRUMENTATION

Some Objects of Current Research

THE rapid progress made since the war in the development of new instruments and techniques for the chemical laboratory is seldom fully realised. Comments made recently that there has lately been a comparative dearth of inventiveness do not pay much regard to the changes, often of a fundamental character, which the availability of new instruments has brought about in the more laborious laboratory methods practised before the war. Modern equipment and methods are not only time savers, they almost invariably permit considerably more accurate results and are opening new possibilities for chemical research.

The past decade has witnessed big changes in the equipment of chemical laboratories. Only a limited number of *p*H recorders, for example, were in existence before the war. To-day, these instruments are recognised as standard equipment in practically all chemical laboratories. Yet there is still scope for further development in this field, for the production of an electric *p*H meter suitable for the full range usually required in chemical analysis presents technical difficulties which have not yet been fully overcome.

Alkaline Resistance

One of the problems here, connected with the design of glass electrode *p*H meters, is the production of an electrode which will satisfy the requirements of electrical conductance and also resist the high alkalinities to which it may be exposed. Changes in the glass have hitherto prevented the production of accurate readings after long periods of use. There appears to be as yet no instrument of this type which will operate in highly alkaline conditions for long periods without requiring the electrodes to be changed.

Much work has been done in recent years on the use of the infra red spectrum. This technique is particularly valuable for analysing fairly large organic molecules where the characteristic spectra have strong lines outside the ordinary visible range, so that they cannot be investigated by ordinary spectroscopy. Considerable attention has been devoted both at Oxford and Cambridge and also by the Ministry of Supply to the development of this technique and industry has produced infra-red spectrometers capable of quantitative analysis of organic mixtures by automatic operation.

This problem is closely associated with the development of improved detectors. They are of various types. They may be thermocouples, bolometers, or semi-conducting materials known as selective detectors because they respond only to a limited range of wave-lengths. The suitability of these various types is determined by the particular application for which the detector is required. A great deal of work has been done by industries, universities and Government laboratories in improving detectors and since the war rapid advances have been made.

Thermocouple Problems

One of the major difficulties has been to get a quick response with a thermocouple. The output from a thermocouple is very small and therefore requires to be amplified. To produce a d.c. amplifier which is both sensitive and trouble-free is extremely difficult. The alternative is to interrupt radiation by means of a rotating vane, thus causing a pulsating beam to fall on the detector and so produce a pulsating output, which can be amplified by the extremely sensitive and relatively trouble-free a.c. amplifier. Difficulties are presented, however, by the fact that to get a satisfactory a.c. amplifier the interruption frequency must be relatively high, whereas to get a measurable response from the thermocouple it must be low.

This problem has not been solved but progress has been made in two directions. Government laboratories have succeeded in producing a satisfactory amplifier which is sufficiently sensitive and operates at very low frequencies. Hence the thermocouple can be used with low interrupter rates.

Industry's solution to the same problem has been the production of thermocouples so small and so delicate that their thermal capacities are very low. Thus they respond much more freely and can be used with higher frequencies.

Important advances in the use of infra-red spectrometry have also been made in the growing of crystals. Glass is unsuitable since it absorbs infra-red radiations. The usual crystal transmitters are quartz, rock salt, potassium bromide or potassium iodide. Recently a substance known as "K.R.S.5" has been developed, which is

particularly useful as a window material, because it transmits in wave length regions where most other substances absorb.

Of great interest to chemists is the general purpose mass spectrometer of the kind displayed by Metropolitan-Vickers at the Physical Society Exhibition. It is intended for measurements of ions having m/e ratios between 1 and 250. Without modifying the instrument, any of the more common types of problem encountered in mass spectroscopy can be investigated, such as isotope assays, studies of ionisation and dissociation, analysis of hydrocarbon mixtures, etc. Less common problems, such as gas reactions and the formation of intermediate products of combustion, can be studied with a minium of instrument change.

Measurements of abundance to an accuracy of ± 0.5 per cent are already obtainable for all isotopes present to the extent of 1 per cent, or more of the most abundant isotopes. Any single peak or any desired portion of the spectrum can be recorded on a 10-in. chart.

The Quantometer

Interesting possibilities are also presented by the quantometer, an instrument which has been developed in the U.S.A. and is reported to be the most rapid method yet devised for the analysis of metallic substances or chemicals. Whereas a qualitative breakdown is usually obtained by means of the spectrum of a particular mixture, the quantometer makes it possible for the constituents to be estimated quantitatively. Thus the time taken may be reduced from a matter of days to as many hours.

This system is based in effect on diffraction characteristics. A complete electronic unit, it requires a team of physicists, electronic engineers as well as a chemist to prepare the substance for analysis.

For any laboratory where continual analysis of a few products is required, the quantometer should be ideal. It may fill a great need in the production of non-ferrous alloys. No quantometer has, so far as is known, yet been employed in this country.

Another example of a new instrument likely to be of major importance is the automatic constant volume fraction collector, which was developed by the Chemical Research Laboratory, DSIR.

This apparatus is designed to collect separate fractions of eluent of constant but predetermined volume. The action is based on the interference of a beam of light falling on a photo-electric cell by the rising meniscus of the liquid being collected. The interruption of the beam operates a mechanism so that the vessel, filled to a predetermined level, is replaced by an empty one. The particular advantage of this apparatus is that constant volumes of liquid can be collected independently of variations in rate of flow, drop size of eluent, or specific gravity of the liquid. In addition, each fraction is collected without coming into contact with any portion of the preceding fraction.

Ultrasonic methods, not very extensively used, seem to present attractive possibilities for future development. There has been an increasing realisation during the past two or three years of potentialities. It is interesting to note that a general purpose ultrasonic generator is being placed on the market.

One attraction in the chemical field is the possibility of emulsification by ultrasonic radiations. This technique is being developed and has proved successful with mixtures which normally will not emulsify or which quickly separate out again.

Ultrasonics is also serving to initiate crystallisation in supersaturated solutions and to initiate certain reactions under conditions where they do not normally occur. It is possible that the same principle might also be the means of accelerating reaction rates.

Considerable attention is being devoted at present to the possibility of using pulverised fuels. To make the best use of this type of fuel it is necessary to ensure that each particle has the maximum surface exposed to the oxygen in the furnace atmosphere. That is secured if the particles are kept in motion. It has been suggested that by applying strong ultrasonic vibration the fuel particles might be kept in motion without the need for strong air current.

Ultrasonic Frequencies

The speed and readiness with which ultrasonic frequencies are transmitted by different substances depends to some extent on their molecular structure. Hence measurement of the velocity of transmission within a substance provides a means of distinguishing between materials. This can be done by passing a ultrasonic beam down a tube containing the specimen under examination, and using standard cathode ray tube technique to measure the time of transmission through the specimen.

Ultrasonics can be used for the polymerisation of various substances such as acetic acid and also to break down polymers into small molecules.

(*continued on page* 609)

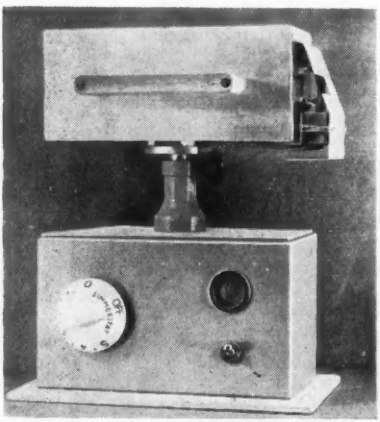
New Aids to Microchemistry

Semi-Automatic and Time Saving Devices

by Dr. JOHN T. STOCK, Ph.D., M.C., A.R.I.C.

MOST of the standard laboratory apparatus has been developed from prototypes improvised by enterprising workers to serve particular purposes. That the spirit of innovation and the capacity to introduce useful refinements of familiar laboratory apparatus is as active as ever was evidenced at the recent exhibition of new microchemical apparatus in the department of chemistry and biology of the Sir John Cass College, London, E.C.3.* The keynote of this was the abundance of well designed and effective instrument modifications, of which a large proportion deserve the attention of makers of standard equipment.

Mr. G. Ingram exhibited three beautifully constructed pieces of apparatus. The split-type micro-combustion furnace[1], for the determination of nitrogen, halogens, or sulphur (Fig. 1), exemplified simplicity of construction from readily available materials. The heater block is cut from a commercial refractory insulating brick, channels being drilled and filed to accommodate the combustion tube and the four alumina tubes containing the nichrome heating coils. In this manner, replacement of a burnt-out heating element is greatly facilitated. A simmerstat is provided for the control of the operating temperature.



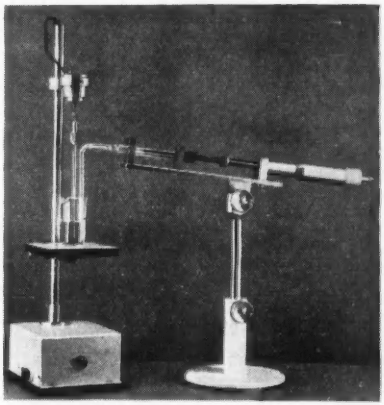


Fig. 1 (below). Split-type furnace with replaceable heaters. Fig. 2 (above). Micro-stirrer and syringe micro-burette

In a neat horizontal-type micro syringe burette of 1-ml. capacity (Fig. 2) the ejection of the reagent is accomplished by rotating the thimble of a specially-constructed micrometer screw head, which gives a delivery of 0.0005 ml. per division.

The power for the miniature electric driving motor of the micro-stirrer outfit (also shown in Fig. 2) is supplied by a small battery housed in the base of the unit. Although the motor runs very well on 1.5 volts, a higher figure is required for starting. This is provided by a booster starter button which on being released restores the voltage to that suitable for running. Rack-and-pinion adjustment is provided for the height of the titration platform, which is constructed from white plastic. A chuck on the motor shaft permits the stirrer head to be changed.

Heating blocks for micro-electrolytic apparatus were described and exhibited by Dr. A. J. Lindsey. Although the water bath used in the original Lindsey-Sand apparatus[2] provides a simple method

* Organised by the author at the invitation of the Microchemistry Group of the Society of Public Analysts and other analytical chemists, and held in the college by courtesy of the principal, Dr. A. M. Ward, and the head of the department, Dr. A. J. Lindsey. Short papers on the new apparatus were submitted by the originators.

of heating the electrolysis cell, the manipulation when terminating an electrolysis is a little difficult. To overcome this, aluminium alloy heating blocks were designed to replace the water bath. These are divided vertically so that the hot segments may be lifted away and replaced by interchangeable cool ones without interfering with the alignment of the cell. The prototypes are being developed into patterns suitable for gas and for electrical heating respectively.

Simplifying Pressure Regulators

A one-piece pressure regulator and flowmeter, simpler and easier to use than the Pregl regulator and bubble-counter, was described and exhibited by Dr. W. T. Chambers. The desired pressure is maintained constant simply by allowing the gas to escape from the leg of a T-piece into an adjustable head of water. When, as in certain carbon-hydrogen combustion trains, different gases are metered alternately, the one regulator suffices. Coloured paraffin oil is the indicator liquid in the Friedrich-pattern flowmeter. The scale, being clipped to the limb of the U-tube, is readily adjustable to zero and, by turning through 180°, enables the apparatus to be used either right to left or *vice versa*.

Dr. Chambers also showed a micro-combustion tube for halogens and sulphur[3]. This is of quartz and operates at 800°-900°. It contains a sintered disc and quartz wool only and is made in one piece with a modified Hallett absorption tube. Samples of from 5 to 10 mg. are readily combusted in 20 min. and the combustion products may be washed out for a titrimetric finish. If only one of the elements S, Cl, Br, I is present, a single determination may thus be completed in 30 min. The combination of flowmeter and combustion tube with sintered disc greatly facilitates the combustion of volatile substances.

The routine quantitative ultimate analysis of organic compounds may be rendered in part automatic. Greater freedom is thus afforded to the analyst, and the essentially constant combustion conditions render the analyses more uniform. Further, with such an apparatus, an inexperienced operator can obtain results better than he can get from a manual apparatus.

With these factors in mind, Mr. F. J. McMurray designed the extremely workmanlike electrically-heated semi-automatic micro-combustion furnace (Fig. 3). It is for the determination of nitrogen, halogens, or sulphur. To facilitate rapid cooling of the combustion tube at the completion of the determination, the heater units are tilted backwards as shown; when the combustion is actually in progress the units enclose the combustion tubes and the front covers are lowered.

The shorter heater unit providing for the vaporisation of the sample is advanced along rails at a slow controllable rate by means of a spring-loaded half nut engaging a lead screw. A geared motor drives the screw by a small roller chain. Since the refractory cement blocks in which the heater windings are imbedded have large heat capacities, temperature variation is small. Describing an actual test carried out with the apparatus, the designer mentioned that 13 correct results were obtained in an 8½-hour day.

The sensitivity of optical techniques renders them of great value when concentrations are low or the size of sample is small[4]. This, in addition to the simple but ingenious design of the apparatus, probably accounted for the lively discus-

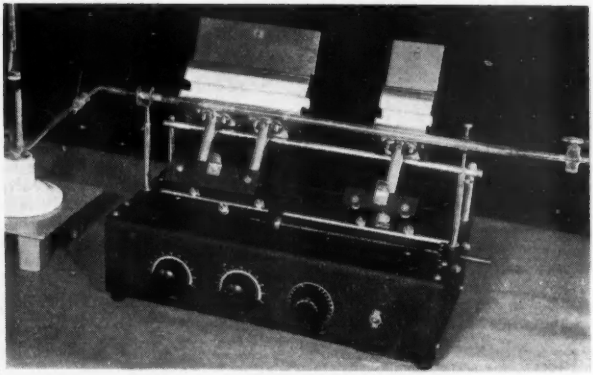


Fig. 3. Successful application of the time-saving principle illustrated by a semi-automatic micro-combustion furnace for the determination of nitrogen, halogens or sulphur

sion arising from the description of a photoelectric micro nephelometer[5] given by Mr. A. C. Mason.

In the usual type of nephelometer, the intensity of the scattered light does not increase linearly with the concentration, but tends to a limit beyond which a further increase in concentration has little effect. This is because the light scattered by the lower layers of the suspension is prevented from reaching the observer by the turbidity of the upper layers. By suitable design, which also permits the examination of as little as 0.1 ml. of a sample, this defect may be minimised. Increased sensitivity, a greatly extended concentration range, and applicability to coloured solutions are thus obtainable.

The nephelometer cell A, shown diagrammatically in Fig. 4, is constructed from an ordinary one-inch diameter boiling tube. Except for a narrow side window for the admission of light and a bottom window through which the scattered light emerges, the exterior is silvered. The sample is placed in tube B and is illuminated by a microscope lamp. Light scattering is measured by the current produced by photoelectric cell C.

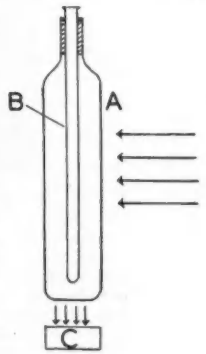
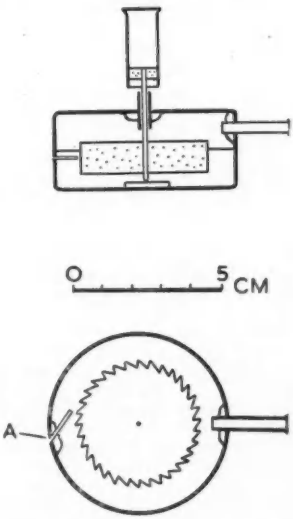


Fig. 4

Even when the central tube contains water, considerable light scattering occurs and a high zero reading is obtained. To compensate for this, the circuit arrangement (Fig. 5) is used. With water in the central tube, potentiometer P is adjusted until the galvanometer deflection is zero. Without altering the potentiometer setting, the turbid solutions are then examined. With bacterial suspensions, the relationship and concentration are practically linear.

Various vacuum-operated stirring devices[6] were described and demonstrated by Mr. M. A. Fill. In the version shown in Fig. 6, stirring is achieved by rotating the titration vessel. The body consists of two large Bakelite caps from screw-top reagent bottles, which are joined mouth-to-mouth by a band of adhesive tape. A disc of cork having some 32 teeth cut in the periphery forms the rotor 6A. The spindle is a portion of a darning needle running snugly in a glass bearing mounted in the upper cap. Since the point of the needle presses on a scrap of microscope slide waxed to the lower half of the body, running is almost frictionless.

When filter-pump suction is applied to the side tube, the blast of air entering through jet A impinges upon the rotor and causes the latter to turn. The upper end of the spindle carries a short length of glass tubing into which is slipped the



Figs. 6 *and* 6A. *The vacuum-operated stirrer and its cork disc rotor*

tube containing the sample to be titrated. Agitation results from the encounter of the rotating solution with the stationary burette tip. With slight modification, the motor may be operated in an inverted position, so that it can be used for the more usual method of stirring.

When a solution in a closed system has to be agitated, or when, as in micro-electrometric titration, the presence of electrode system and burette tip leaves little room for the entry of the normal type of stirrer, the magnetic bar method is parti-

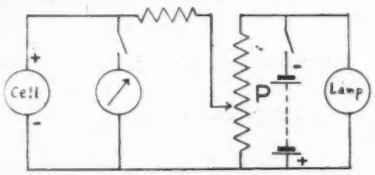


Fig. 5

cularly valuable. A micro-stirrer operating on this principle is shown in Fig. 7.

Mounted on the spindle of a vacuum motor is a light, powerful magnet B in

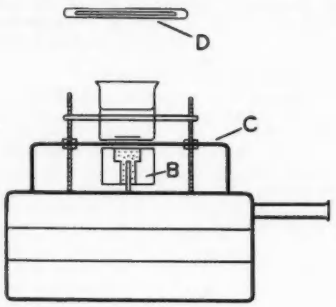


Fig. 7

the form of a slotted cylinder. Platform C is a smaller bottle cap held down by two fine brass bolts. When the stirrer bar D (a 7-mm. length of sewing needle sealed in a short piece of melting-point tube) is dropped into the titration vessel standing centrally upon the platform, the stirrer bar follows the rotation of the magnet. Since the agitation is greatest at the bottom of the solution, highly-efficient stirring without splashing is obtained.

Bottle Caps

Mr. Fill described various clamps and stands for microchemical apparatus[7]. These are constructed mainly from glass rod and bakelite reagent-bottle caps. A typical example (Fig. 8) is designed to permit the inverted vacuum-motor stirrer E to be lowered into position. On turning knob F projecting from bosshead G (yet another pair of bottle caps!), the glass-rod hairpin upright moves up and down. Movement is accomplished by two small rubber rollers pressing upon the sides of the upright.

An improvised microburette[8] was also exhibited. This is of the tapless variety and is constructed from a 1-ml. graduated pipette. Delivery is controlled by the operation of an ordinary screw clip.

Hydrogen sulphide delivery systems[9] were discussed by Mr. P. Heath. Treatment with hydrogen sulphide may be effected either by allowing the gas to bubble through the solution or by the "pressure" method. For the first method, Mr. Heath described a modified Lidstone-Wilson generator.[10] In place of the usual tapered delivery tube, a fine

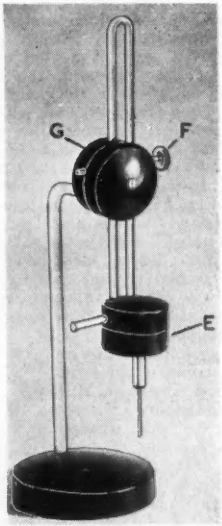


Fig. 8. More ingenious and effective use of bottle caps

parallel capillary, easily drawn from scrap glass tubing, is employed. After use, the capillary is thrown away, thus eliminating any risk of contamination.

The arrangement is shown in Fig. 9. Having sealed the end of the generator side arm projecting beyond the stopcock, a hole some 3 mm. in diameter and inclined downwards at 45° is blown near the end. A diaphragm is then formed over the hole by slipping on a short length of thin rubber tubing. Using a red-hot needle, the centre of the diaphragm is punctured and marked with a white-ink cross. On thrusting the end of the capillary into the hole, secure gas-tight gripping occurs.

Because of the favourable area-to-

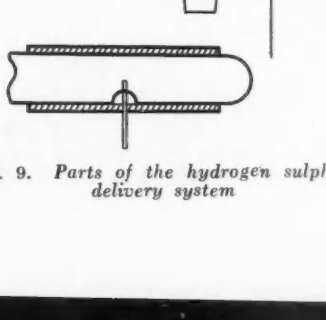


Fig. 9. Parts of the hydrogen sulphide delivery system

volume relationship of small samples, the "pressure" method of saturating solutions with hydrogen sulphide is very efficacious on the semi-micro scale. Precipitation is carried out in a micro test tube using a short length of glass tubing as a delivery attachment. One end of the latter is connected to the generator, the other carrying a stopper of rubber tubing fitting snugly into the mouth of the test tube.

Having first displaced the air above the solution by easing the stopper, the latter is thrust firmly home and precipitation completed by gentle tapping. This method does not require high-pressure hydrogen sulphide and works well with an ordinary Kipp generator.

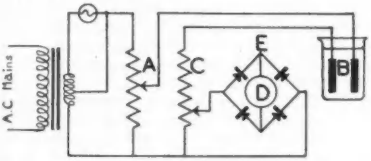


Fig. 10. *Circuit for conductometric titration*

Apparatus for conductometric microtitration[11] was described by the author. The circuit of the titration unit (Fig. 10) is based on the well known principle of applying a fixed voltage to the conducting system, when the current flowing is directly proportional to the conductivity.

Potentiometer A, connected across one portion of the secondary of a bell transformer, enables any a.c. voltage up to 2.5 to be applied to the electrodes B. Potentiometer C controls the sensitivity of meter D, which is a 0-1 mA moving coil instrument. To enable the latter to respond to a.c., an instrument rectifier E is incorporated in the circuit.

Micro-electrodes,[11,12] constructed as shown in Fig. 11, from two melting-point tubes and a few inches of platinum wire, are used. Two short lengths of cycle valve tubing FF and a bead of glass G hold the assembly rigid. Such electrodes may be bent for use in samples of limited depth and are platinised in a few minutes. Because of their small effective area, the electrodes do not behave well in highly conducting solutions, obtained with solutions of moderate conductivity (*e.g.*, solutions from N/1000 to N/100 with respect to strong acids).

Fig. 11

Having immersed the electrodes in the solution, the applied voltage is adjusted until a suitable meter reading is obtained. If the conductivity is expected to decrease during the titration, this reading may conveniently be full scale. The titrant is then added in portions, the meter reading being noted after each addition, and the titration curve plotted from the pairs of meter and burette readings. Besides the vacuum-operated version described, two electrically-driven models,[13] one for bench use and the other designed to fit into a retort ring, were exhibited.

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NEW TRENDS IN INSTRUMENTATION

(*continued from page* 604)

A new possibility for leak detection, still in the laboratory stage, is presented by an American apparatus for the detection of certain gases, particularly halogens. This consists of a measures the conductivity of air at ordinary atmospheric pressures between a hot platinum electrode and a cold electrode, the positive ion current being recorded.

It has been found that a minute quantity of certain gases, notably halogens, causes a large increase in conductivity. A minute quantity of one of these detectable gases is introduced into the vessel to be tested, and any leak will allow the gas to pass through the meter and be recorded.

Another notable development is the use of radio-active isotopes for determining the structure of synthetic molecules. This is calling into being an entirely new range of instruments of great importance to the chemist in the development of electronic computors for doing the calculations which are involved in evaluating the analyses of complex molecules by X-ray spectroscopy. The mathematical analysis of the results is exteremly complex and would take months or even years.

THE SYNTHETIC WAXES
Attempted Classification and Definition

IN a comprehensive paper on synthetic waxes read before the Centre de Perfectionnement Technique and now published (*Chim. et Ind., 63* (3), 1950, 239-245) Dr. L. Ivanovszky, of Abril Corporation (Great Britain), Ltd., endeavoured to introduce some order and clarity into a branch of chemical industry in which hitherto confusion and the absence of logical definition have been conspicuous.

Starting with the question of definition, he proposed this: *Waxes are a specific group of organic thermoplastic substances, mostly opaque, with m.p. usually between 50° and 90°C., but sometimes (exceptionally) up to 200°C., yielding liquids of relatively low viscosity without ropiness or filamentation, and forming pastes (dispersions) or gels, having generally lustrous properties.*

Characteristic constituents of most waxes are long-chain paraffins and their derivatives—including normal and iso-hydrocarbons, alcohols, ketones, acids; also ethers, esters, and pseudo-esters with aliphatic and aromatic compounds. Most waxes should, moreover, be regarded as polymers, aggregates and/or "alloys," this latter term being used advisedly in view of the close analogy between waxes and true alloys. But much yet remains to be elucidated on the structure of waxes.

Defining "Synthetic"

Waxes may be classified as (a) natural-animal, vegetable, mineral, (b) refined (natural), (c) chemically modified, (d) synthetic, (e) compound. The term "synthetic" should be restricted to waxes which differ essentially from the raw materials used and result from chemical processes which are often complicated. From the strictly scientific point of view they are to be regarded as products of important chemical changes and partial synthesis. At present there are strictly only three synthetic processes: hydrogenation of a carbon oxide (FT waxes), low temperature hydrogenation of carbon (TTH waxes), and ethylenic polymerisation (Alkathenes, Polythenes, Lupolenes).

The conversion of these hydrocarbon waxes into those of fatty acids, alcoholic or ketonic waxes, or of esters or other condensation waxes, leads to a series of purely synthetic waxes, if the hydroxylated constituents used are themselves synthetic; but the conception of true or purely synthetic is only of theoretical interest.

It is more important to inquire if the synthetic waxes are true replicas of the corresponding natural substances. In some cases this is so, as with the hydrocarbon waxes which are similar to paraffin wax; and in some other cases there are analogies or similarities. In such instances the synthetic product may be superior or inferior to its natural analogue, but in any case offers greater variety of properties.

The difference between the natural ester waxes and the synthetic resides in the fact that the latter contain various glycols, etc., but do not contain fatty alcohols of high molecular weight in appreciable quantities. Some therefore are completely saponifiable, while others (pseudo-esters) are practically unsaponifiable. Some qualifications of these terms in respect to waxes are discussed.

Intermediates and End Products

In regard to other characteristics or constants, those usually listed are insufficient to distinguish or evaluate waxes. The author briefly deals with some new ones recently introduced, such as *Rn* and *Re*, retention index (or number) and retention effect respectively.

Diagrams illustrate the relations between raw materials, intermediates, and end products in the manufacture of synthetic waxes. In many cases, end products or waxes serve as intermediates for other synthetic waxes or mixtures. A table gives names and classification of a large number of waxes, including many I.G. types, as well as those of Abril, I.C.I., Ltd., etc., with notes on composition and manufacture. These are classified under the different heads: fatty acid, esters, pseudo esters, ethers, ketones, etc.

An important property in evaluating waxes is their melting point, although its importance can be exaggerated, for the tacit assumption that this implies other properties is sometimes invalid. Another important feature is colour. The synthetic waxes are supplied to very definite specifications, of precise chemical composition and characteristics. They often possess properties whih cannot be claimed for analogous natural products.

The author concludes with the important question of raw material costs, with special reference to the I.G. products, many of which were available only in relatively small quantities.

Radioactive Isotopes in Industry

Emergence of Experimental and Practical Equipment

by K. FEARNSIDE, M.A., A.M.I.E.E.

SINCE the construction of atomic piles, radioactive materials which were formerly produced by laborious and costly refining of minerals have become available in almost unlimited quantities. The use of naturally occurring radioactive materials was confined almost entirely to pure research and to therapy, whereas the artificially produced materials from the atomic piles is finding an ever growing number of uses throughout industry generally.

Nowadays it is believed that almost the entire mass of an atom is concentrated in the centre at the nucleus. It is found that the chemical behaviour of the atom is governed by the number of protons in the nucleus, which are therefore chemically identical, but have different numbers of neutrons and so different weights, and are known as isotopes of one another. A distinction is made between them by putting the weight after the name or chemical symbol of the element. Bromine, for example, has nine known isotopes, only two of which are stable—Br^{79} and Br^{81}.

The number of neutrons has, however, a controlling effect on the nuclear properties of the atom, and if there are too many or too few neutrons compared with the number of protons, the nucleus will be unstable and will endeavour to reach a stable state by the emission of radiation. Most materials when placed in an atomic pile will absorb some neutrons and become unstable.

Three Types

The radiations which are emitted depend on the radioactive isotope concerned and fall into three classes, α, β and γ. α radiation consists of fast moving helium nuclei and is associated chiefly with the naturally radioactive elements. β radiation consists of fast moving electrons having a maximum energy which varies from one radioactive element to another.

Their range in air is about one metre, depending on the energy, and it is correspondingly less in denser materials. In passing through matter they collide with and knock electrons out of the atoms in their path, causing the material to become ionised. γ rays are electromagnetic radiations of the same nature as X-rays but having a shorter wave length because of their greater energy. They are only slowly stopped by air or other matter, which they ionise to a much smaller extent than do β rays. Some radio isotopes emit both β and γ radiation, while others emit only β radiation.

The other characteristic of a radio isotope is its half-life. This is the time during which the number of unstable atoms originally present decays to half and varies from a fraction of a second to millions of years. For practical use, values between a few hours and a few years are normally chosen.

Radio isotopes are detected and measured by the ionising effect of their radiations. Two instruments are commonly used—the ionisation chamber and the Geiger counter. The ionisation chamber consists of a chamber filled with gas at one or more atmospheres pressure and having conducting walls and central electrode insulated from them. A sufficient voltage is applied to the central electrode to ensure that any ions formed in the gas will be collected by it, so that the current in the chamber is proportional to the amount of radiation passing through it. The Geiger counter, on the other hand, is a chamber filled with a mixture of argon and ethyl alcohol or other suitable gases at a pressure about one-tenth of atmospheric.

The central electrode is normally a very fine wire at a positive potential with rays

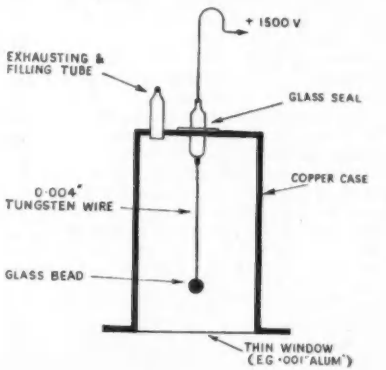


Fig. 1

to the case (see Fig. 1). When an atom is split inside the counter the resulting electron is violently accelerated towards the centre wire and ionises more atoms in its path. This means that for each β ray which enters the counter a large burst of electrons strikes the centre wire.

This is in effect a pulse of electric current and can be amplified and made to operate a meter so that each incoming β ray is actually counted. The mechanism of counting γ rays is similar but because of the small amount of ionisation along their path only about 1 per cent of the incoming γ rays will be counted.

Great Sensitivity

Because each β ray which enters a counter can be counted, it follows that very small quantities of active material can be detected and measured. In fact, about 10^{-15} gms. of active material with a half-life of 10 days can be measured with an accuracy of 1 per cent using normal techniques. A small quantity of active material can therefore be used to detect the presence of inactive material of similar chemical composition and study its path through a series of reactions.

The classical example of the tracer method is Hevesy's study of the uptake of lead in shoots of the horse bean, which were carried out in 1923. Plants of the bean were grown and the roots were placed in solutions of lead nitrate mixed with thorium B nitrate (thorium B being a naturally occurring radio isotope of lead which emits both β and γ rays and has a half-life of 10.5 hours). After periods of some hours the plants were washed with distilled water, the individual parts were ashed separately and the radioactivity present was measured by means of an electroscope. The thorium B solution would, if carrier free, be about 10^{-12}N with respect to lead.

Some results extracted from Hevesy's table for the translocation of lead in carrier solutions of different strengths are given in Table 1. The lead content of different ashes is estimated by the radioactive materials present. By comparing the lead content of leaf and root ashes the conclusion may be drawn that the roots can hold back small quantities of lead from getting through to the rest of the plant. From stronger solutions, however, a greater proportion of the lead gets through the roots to the leaves.

Strength of $Pb(NO_3)_2$ – Percentage Content of Ash

	Root	Stem	Leaves
10^{-6}N	0.052	0.0001	0.00002
10^{-5}N	0.26	0.002	0.0003
10^{-4}N	10.0	0.04	0.004
10^{-3}N	38.0	20	12.0

In the industrial field the tracer technique is already widely employed in the laboratory as a means of studying chemical reactions but has not yet been widely applied to the study of process efficiency on the manufacturing scale. A certain company was in the business of liquefying air and separating its components. In addition to liquefying nitrogen and oxygen, it was interested in recovering the noble gases such as krypton and xenon.

The demand for these gases exceeds the available supply, since there is only one-tenth of a part of a million of krypton and one-hundredth of a part per million of xenon in air. This particular company found that there were only small proportions of the available krypton and xenon being recovered in their plant, and wished to find out where these materials were going in the process and how to effect their recovery.

Radio active krypton and xenon were introduced in a fixed proportion with the incoming air prior to liquefaction and the air was analysed at different points in the process be means of a Geiger counter. This enabled the krypton and xenon present to be determined with an accuracy at a few parts per billion of air, since the radioactive krypton and xenon introduced remains in a fixed proportion to the known radioactive krypton and xenon which is naturally present in air. As a result of these analyses, process efficiency was greatly increased.

Control by Radio Isotopes

The continuous measurement and control of the weight of sheets of material moving at the speed normal in most manufacturing processes has been a difficult problem for a long time, but this has been solved by the use of radio isotopes.

As stated above, when β radiations pass through matter they collide with the atoms in their path and remove electrons from them. In this process the electrons which constitute the β radiation lose energy and are eventually stopped. Their range depends only on the density of the matter in which they are moving, and is usually quoted in mg. per sq. cm.

When a radio isotope emits β radiation, not all the electrons which constitute the radiation have the same energy, and in fact for thallium the distribution of energies has the shape shown in Fig. 2 (*overleaf*). This means that, in passing through matter, some of the electrons will be stopped and the fewer will get through.

If a source of β radiation is placed be-

neath a sheet of material and an ionisation chamber is placed immediately above it the rate at which radiation enters the chamber will depend only on the weight per unit area of the material interposed. For control purposes the current may be shown on a meter which has been calibrated previously with various weights of paper, so that the operator can correct the weight, or can be used to operate a suitable servo mechanism.

Since the source has a finite half-life, it is necessary to recalibrate the meter at frequent intervals if inaccuracies are to be avoided. This may be inconvenient in certain circumstances and can be avoided by the arrangement shown in Fig. 3, where a standard piece of material is used as a reference.

Different isotopes are necessary for different ranges of weight. For weights up to 150 mg. per sq. cm., thallium 204 may be used. This isotope has a half-life of 2.7 years and emits β radiation of 0.87 million volts maximum energy. Other isotopes may be used for even greater weights.

Dissipating Static Charges

Static charges build up on a fast moving belt of paper because electrons are torn from the atoms of either the paper or the rollers over which it passes. Thus static electricity is caused by either a deficiency or excess of electrons on the surface of the paper. When β particles pass through a gas some electrons are separated from their parent atom and the gas is said to be ionised.

If this ionisation occurs in the neighbourhood of a sheet of static charge, there is an attraction between opposite charges which come together and neutralisation occurs. If, then, as the belt moves along, the air surrounding it can be ionised to a sufficient extent, the static charges will leak away to the ground. This can be done most conveniently by

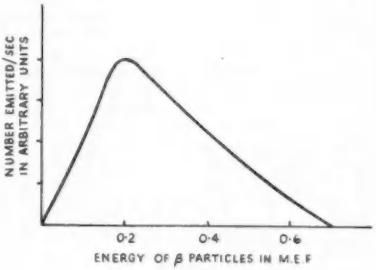


Fig. 2

mounting a radioactive material on a suitable backing and placing it so that the emitted β particles pass through the air immediately surrounding the paper.

As against other means of dissipating static charges, the radioactive method has several advantages. Although some time is taken for the sources to be produced in the Harwell pile (one to three months), they involve no elaborate equipment and they are inexpensive to buy. They require no maintenance and, although the activity of the source decreases over a period of time, they need to be replaced at intervals of time which will probably amount to a number of years. No high voltages are involved, so that the danger to personnel is avoided, and radioactive isotopes are chosen which are pure β emitters, so that radiation health hazard is negligible.

Because of its reasonably long half-life and high specific activity, thallium 204 is one suitable isotope to use. Replacement is necessary every three or four years.

It is hoped that this brief explanation has shown some of the possibilities made available to the large-scale production of radioactive isotopes. To encourage these uses in industry, Isotopes Developments,

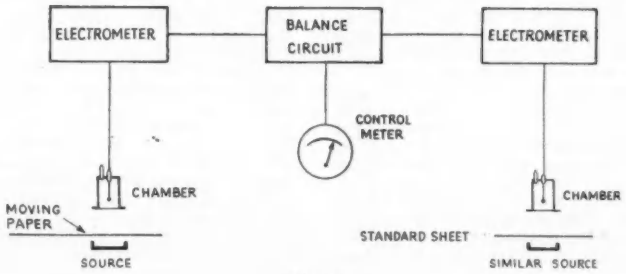


Fig. 3

Ltd., was recently formed with the backing of a group of large industrial undertakings with three specific objects.

The first of these is to advise firms wishing to undertake tracer experiments on the best way of carrying out the experiments they have in mind, and to supply a complete range of equipment for experimental purposes. Then, for those firms which will benefit from experimental work of this kind but who do not wish to undertake the work themselves, the company proposes to carry through complete investigations either in their laboratories or in the works of the firm concerned, and provide the equipment, the isotopes, and the scientific effort necessary for the investigation.

This company also develops and manufactures new instruments for process control in which isotope techniques are used. The Beta gauge for measurement of weight per unit area, described above, is the first of these.

Chemical Development in U.S.A.

NEW chemicals now reaching large-scale production for the first time were reviewed by Mr. Harry B. McClure recently at the annual meeting in New York of the Commercial Chemical Development Association.

The occasion was the presentation by the president of the association of its first honour award to Mr. McClure, vice-president, carbide and carbon chemical division, Union Carbide and Carbon Corporation.

In his address "Recent Case Studies in Chemical Development," Mr. McClure showed that of 42 products sold in carload or tank-car quantities for the first time in the last two years the average rate of progress from test-tube stage to tank-car production was five to six years. In six cases, however, the time taken from initial drum shipment to carload stages had taken only two years.

The great interdependence of the chemical industry was also emphasised by the speaker. Over half the new products were sold as raw materials to other manufacturers, he said.

The official record of sulphuric acid production in the U.S.A. shows considerable increase. Production in January exceeded 1000 million tons for the first time in history during that period. This represented an increase of 41,500 tons over December, while the total gain was only 24,000 tons. This apparently means that production by the chamber process dropped in a period of over-all production increase.

TOWARDS COLLABORATION

International Chemistry Unions

THE fact that many British scientists were ignorant of the very virile bodies, the international unions collaborating for better understanding of scientific matters, was deplored by Dr. L. H. Lampitt in his address to the Society of Chemical Industry last Monday.

The doctor, whose subject was "Towards International Collaboration in Science," was presented with the International Medal of the society.

Societies and movements for international collaboration had come and gone, he said, but the first really influential body was the International Association of Academies which was followed by the International Research Council and finally by the International Council of Scientific Unions (ICSU).

In 1948 the International Union of Pure and Applied Chemistry was given its present status, with commissions divided into six sections, physical, inorganic, organic, biological, analytical, and applied chemistry.

Dr. Lampitt said that in spite of himself, he had been made president of the applied chemistry section through the defection of the U.S.S.R. nominated delegate who had not put in an appearance for nearly two years.

The urge to collaborate exists, declared the doctor, but two world wars in less than half a century had made things difficult. The main essentials for the success of the international unions were that politics must be excluded; control by scientists as representatives of governments must be avoided; they must be autonomous, they must be willing to work; and further steps must be taken to gain the interest of the national societies.

German Instruments

THE German apparatus exhibition (Achema X—Ausstellungs-Tagung für Chemisches Apparatewesen), to be held at Frankfurt, July 9-16, has been assured of support by 350 of the leading German firms specialising in the manufacture of chemical plant and laboratory apparatus. The building of an additional hall to accommodate the show is contemplated. Papers and symposia will be read on various aspects of scientific equipment supply and use, including some innovations; and special travelling and residence facilities will be available to German and foreign students.

ORGANISING THE INSTRUMENT SECTIONS

Erection and Maintenance of a Large-Scale Unit

by V. H. BROWN, M.I.Mech.E., M.S.I.T.

DURING the past eight or nine years I have been closely associated with the instrument organisations of two large chemical plants, the first being at a war-time factory for producing aviation fuel at Heysham, and the second at the new ICI factory at Wilton.

The Wilton factory is still in its infancy, and most of our energies so far have been directed towards general organisation, design and erection. I propose therefore to give some account of the Heysham factory, particularly from a maintenance aspect.

While we think that these organisations are good, we do not suggest that they are perfect—neither do we suggest that an organisation which is applicable to a completely new plant is necessarily right for existing plant, where adaptation and modification is usually the line of attack rather than setting up something completely new.

On the other hand, every factory has a large number of bread and butter instruments such as flow, temperature and pressure measuring instruments, and the main points of difference lie in treatment of " specials."

War Installation

Round about the outbreak of war the Government ordered the erection of a plant to provide high octane spirit for our Air Force. The plan was based on the hydrogenation process, gas oil imported from Trinidad being the raw material.

Hydrogen for the main hydrogenation process was produced from coke in six large water gas generators. Hydrogen after purification was compressed to about 5000 p.s.i.g. in 5-stage machines. There were 5 hydrogenation process units.

Two four-column frationation units separated the products of hydrogenation into butane, aviation base stock and recycle material.

Instruments installed were very largely standard to the type of plant put down. By far the majority of flow measurements were by sharp edged orifice plates (though there were a few venturis), coupled to proprietory flowmeters. On the high pressure gas side an ICI designed type of ring balance flowmeter was used.

Similarly pressure measurement was by bourdon tube gauges, and temperatures by thermocouples and resistance elements.

While the hydrogenation side had very few automatic controls, the distillation side was practically 100 per cent automatically controlled—on temperature, pressure and level in towers and furnaces. Here again, however, the instruments were essentially standard proprietory units, mostly Foxboro and Kent two term controllers—we had no three term controllers.

Regarding analysis instruments, the katharometer type was used for hydrogen determination on the gas make up system and also on the CO_2 in flue gas on the boilers.

Special Instruments

We had several special type instruments. One to give a record of the CO content in make up gas with an accuracy of parts per million; this was an elaborate set up with a lot of vulnerable glasswork, which needed quite a lot of attention to maintain it in a working condition—the results were so important for plant operation however that the excessive maintenance was considered worth while.

Another special instrument was one affectionately referred to as the " baby "—a unit devised to give an anticipated H_2 content of a mixture of gases after passing through a catalytic process. Then there were several *p*H meters—one of the raw water supply of the antimony electrode type, used to control the *p*H of the incoming water to the factory.

I frankly can't give you actual numbers, but you will gain some idea of the extent of the instrumentation when I tell you that the installed value was approximately £250,000.

Our personnel was drawn from two main supplies; firstly from fairly well trained men from the parent companies (ICI and Shell); secondly from local labour. The total number was of the order of 70-80, which included artificers, attendants, relaxees, apprentices, records and staff. I shudder to think what we should have done in the early days without that nucleus of

* Abstracted from a paper delivered to the Society of Instrument Technology at a meeting held in London on April 25 by Mr. V. H. Brown, instrument manager, Wilton Works, I.C.I.

trained men from the parent companies.

We had two instrument stations at Heysham. The Central Instrument Station located on the hydrogenation site, and a second station on the refinery site. This consisted of an ex army hut split up into an office and small sub store at one end, the remainder being divided into two work rooms, one for heavy and the other for light calibration work.

The Central Instrument Station was well designed. I should like to make a special reference to the advantages of locating the Instrument Store in the Station. Walking time and working time is saved; faults in incorrect ordering are more quickly remedied; unloading of instruments under a trained eye is invaluable; closer co-operation between instrument foremen and storekeeper can be maintained, a helpful factor when dealing with specialist instrument stores.

Calibration

A detailed description of calibration apparatus and methods does not form part of this paper; it is a most important subject, however, and brief mention of some of the apparatus in use at Heysham will not, I feel, be out of place.

Flow: For routine calibration in the shop we had a number of brackets fixed to hold the various types of flowmeters. Adjacent to these were arrayed a series of vertical manometers—up to about 100 in. water for meter ranges up to this limit, and Hg manometers for higher ranges. After cleaning and reassembly, the H.P. leg of the flowmeter was connected to the appropriate manometer and a compressed air supply, and several check points taken throughout the range; the LP leg was left open to atmosphere.

All orifice plate calculations were made in the station, using data available to ICI companies; this data is the result of a large amount of experimental work carried out at Billingham over a long period.

For calibrating pressure gauges and recorders we had the normal dead weight testers for medium and high pressures, and Hg manometers for LP gauges. For rapid, less accurate testing, standard gauges were used on a common system in which could be connected, say, half a dozen gauges, pressure being supplied from compressed air or foot pump.

Temperature: Measurements were mostly by thermocouple or resistance bulb on the hydrogenation site, and by vapour or liquid in steel bulbs on the refinery site.

For checking we had standard workshops potentiometers, potential dividers, Wheatstone bridges and ancillary equipment for checking resistances; general purpose test meters like avometers; test coils for the resistance element units; oil baths for the steel bulb types; and so on.

For katharometers and gas density recorders we used cylinders of gas, filled with appropriate gas mixtures to about 100 atms. This gas was then passed through the katharometer head, one cylinder being used for zero and a second for full scale deflection.

In view of possible CO_2 condensation troubles, a cylinder of about 2 per cent H_2 in N_2 was made up for checking the CO_2 kaths on the boiler flue gas. The effect of H_2 in air is approximately 7 times that of CO_2 in air in the reverse direction; therefore by using a 2 per cent H_2 gas, and reversing the recorder leads, a reading of approximately 14 per cent CO_2 was obtained (which was the figure at which the plant was working). This test was a comparative rather than absolute check.

A rough test rig for checking tachometers was also set up, using a small synchronous motor and gear wheel trains.

A large number of our controllers were of the Foxboro air operated type. A small test rig was set up for checking the pilot valve setting, i.e., to adjust the pilot valve movement, to give a full outlet air pressure variation of, say, 0-15 p.s.i. for a flapper—bellows system pressure variation of about 2 p.s.i.

For checking positive meters we had some carefully calibrated orifice installations, and also some calibration tanks.

I think the work of the Instrument Department at Heysham can probably be sectionalised under three main headings: normal maintenance, preventive maintenance and records and general office work.

Twenty-four Hour Service

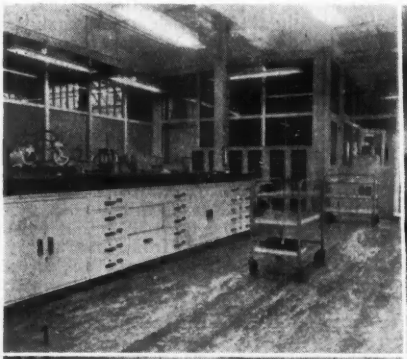
In normal maintenance where plant is operating continuously 24 hours per day it is usually necessary to employ shift instrument men; on a large plant, there are invariably some key instruments which, if out of commission, would seriously inconvenience plant operation. Plant can, however, usually continue to operate for a few hours without a number of instruments, and such instruments can be left over for day attention should they go out of commission during the night.

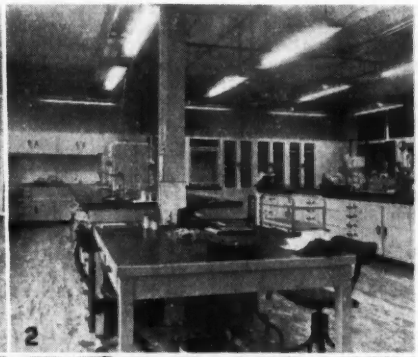
Even more important is it to maintain automatic controllers in commission; it is usually difficult to hand control normally automatically controlled plant and sometimes impossible, apart from the fact that there is often not the available process labour.

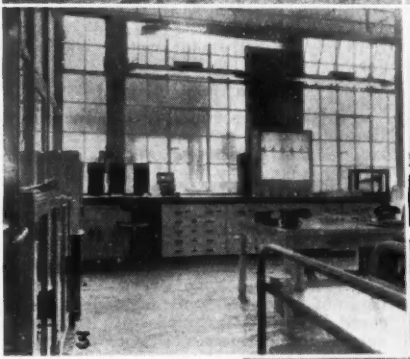
At Heysham we had both key instru-

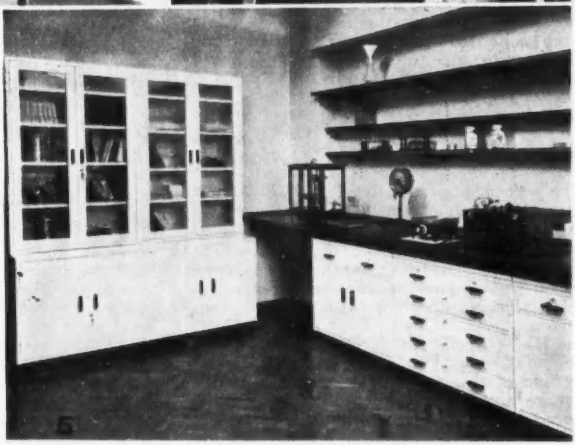
(continued on page 618)

Functional Design in the New Laboratories









Nothing distinguishes more clearly the conditions in which research is carried on today from those of the recent past than the functional form of the most modern laboratories. The principles are well illustrated in these views in the pathological department of the Royal Free Hospital (1,2,3) and the analytical research laboratories of Yardley & Co. (4,5) employing the store enamelled steel unit furniture which can be adapted to changing needs. Counterparts are going to the Department of Health in Ottawa. (Photographs by courtesy of Baird & Tatlock (London), Ltd.)

ORGANISING THE INSTRUMENT SECTIONS

(continued from page 616)

ment and fully automatic controlled plant, and we ran a shift of artificers. The shift men at Heysham kept logs of all work dealt with; their primary function was to maintain instruments in operation, making a good permanent repair where possible, and in other cases a temporary hook-up sufficient to last overnight.

The day staff dealt with any of this latter work, and any other repair jobs which arose. In addition they covered maintenance and adjustment of the more complicated types of instruments.

Our semi-skilled instrument men are known as attendants. These men are recognised by the unions, of which they are members; they are paid agreed fixed percentage of the full trade rate. Their work comprises such jobs as chart changing, checking flowmeter zeros, blowing catchpots, attention to pens, greasing and generally assisting artificers. It will readily be seen that this class of labour is a great help in any maintenance organisation in saving artificers' time.

I have always deprecated the policy of allowing important instruments to remain in operation until they broke down and caused a plant restriction. The careful car owner either overhauls his car, or has it overhauled, periodically, to check various vulnerable components, and does not run it until it lets him down some dark night in a rainstorm.

Routine Overhauls

In the same way, key instruments were given a periodic overhaul at Heysham. Thus, flowmeters and temperature recorders, at periods varying between, say, six and 12 months according to experience and their importance to the plant, were brought into the shop for overhaul and recalibration. This procedure was applied also to pressure gauges, certain analysis instruments, level controls and some weight machines.

Record sheets were kept of such overhauls, which gave a brief history of the instrument, condition in which received at such periodic overhauls, account of new parts fitted, and so on.

I have seen tally systems, say, a board with instruments enumerated down the left hand side, with dates along the top, and a series of hooks on which could be hung coloured discs to draw attention to the dates of routine overhauls: some system of this nature can be quite useful.

Care should be taken, however, not to overdo these routine overhauls. Practically all instruments should receive periodic attention, but instruments should be graded and the period between overhauls varied according to the importance of the instrument to plant operation or costing.

One of the things which struck me during my visit to the U.S.A. some three years ago was the relatively small amount of routine maintenance. Plant managers were more content to operate their plant on trends or variations rather than absolute measurements; a further important point was that fuel costs, particularly where natural gas was being used, were relatively lower, so that plant efficiencies were less important than in this country.

At Heysham the records section was a separate department from instruments. Pressure, temperature and analysis corrections were applied to all flow charts in the instrument section, and all charts were planimetered in our section for average readings where required—flow, temperature and pressure. Also where non-normal balances or tests were to be made, then the help of the instrument section was called for.

Department Liaison

I think it is axiomatic that the closest liaison should be maintained between any records and instrument sections, and preferably that they should lie within one department.

The closest liaison between plant management and instruments is essential. You may think that this is so obvious that it need not even be mentioned; I have known many cases, however, where a good deal of trouble and misunderstanding could have been avoided by a short conversation and a few words of explanation, between the two sections.

At Heysham, apart from interchange of notes and telephone work, a short meeting was held each morning to discuss plant operations through the previous 24 hours, and any unusual maintenance or shutdown programmes for the day ahead; at this meeting were representatives from plant management, mechanical, electrical and instrument maintenance.

Foremen

And lastly a word about instrument foremen and chargehands: I find it difficult to express my appreciation of the work carried out by these men, with their wide practical knowledge, their ability to deal with all types of labour, and their willingness to get down to do a job of work themselves when occasion demanded. On the whole I found their help absolutely invaluable, and not least for the part they played in training raw recruits to become useful instrument workers.

PLASTICS IN THE LABORATORY

Successful Application of the Laminates

From A SPECIAL CORRESPONDENT

CHEMISTS, physicists, biologists and many other scientific workers are finding plastics of increasing value in the laboratory for making specialised pieces of equipment and experimental apparatus which cannot be made satisfactorily from so-called traditional materials, such as metal, wood, glass and ceramics. It is also interesting to note that manufacturers of laboratory benches and other furnishings are now supplying units made of laminated plastic sheets. These are built up of layers of kraft paper impregnated with phenol formaldehyde resin and bonded together under heat and considerable pressure.

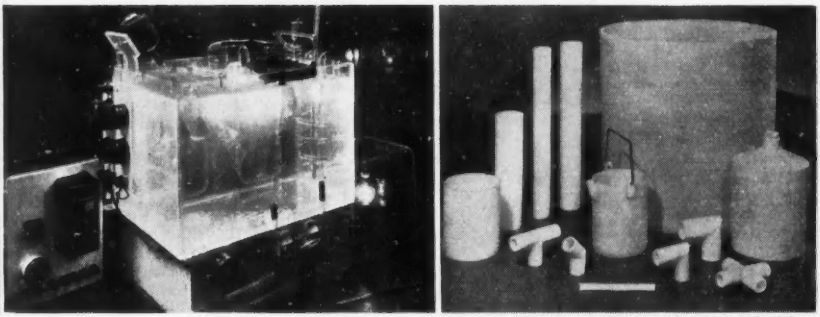
The laminated plastics material is superior to ordinary wood, such as teak, on account of its high strength-to-weight ratio, incombustibility, resistance to water and chemical attack, rigidity and resistance to twisting, warping and bending of its hygienic surface.

The laboratory bench is but one of the several new applications now being found for laminated sheet in this field. In hospitals, medical schools and lecture rooms this material is also used for wall panelling, doors and even electrical heating panels. The latter consist of heating units within the cavity of specially constructed laminated sheet known as Holoplast.

The heating panel can be fixed to all types of traditional building structures. However, should the walls, partitions or ceilings be formed of Holophast panels, the combination of the heating units with the novel girder-like structure of the laminated material results in building components which are not only structural, but which form the heating system at the same time.

The construction of the heating panel safeguards against scorch or burn through contact with the unit. The absence of induced air current, such as is experienced with conventional radiator heating, reduces the chances of infectious disease being carried throughout the building, which is important in a hospital, medical school, bacteriological and pathological departments, etc.

In some laboratories, use has been made of laminated board for the shelves holding chemical reagents. Several advantages are offered by this material for such an application. First, the laminated sheet is non-absorbent and resistant to attack by many corrosive chemicals and solvents. The surface of the sheet is hard, extremely smooth and easy to keep clean by merely wiping it over with a damp cloth. The material is available in a wide range of attractive and permanent colours, as well as black. The laminated panels are easily fitted, either to timber frames or to metal brackets. When fitted, the shelves are



[Courtesy of I.C.I., Ltd., Plastics Division

A thermostatically controlled water bath made from Perspex sheet (left) and pipes and containers in Alkathene

naturally germicidal and do not provide a breeding place for germs. Moreover, they will resist attack by insects, such as termites, and fungus even in tropical climates.

For laboratory applications in the tropics there is no doubt that laminated plastics are of special interest, offering many practical advantages not found with any type of wood. The laminates are available in several different forms, the most important being the special cavity panels in Holoplast for structural work; veneers three sixty-fourths of an inch (1.2 mm.) suitable for application to a plywood core for the construction of doors, furniture or the surfacing of walls, tables and shelves; wall panels, five thirty-seconds of an inch (4.0 mm.) thick. The last named have a similar range of uses but are sufficiently strong and stable to be used without any backing material.

Instrument Panels

Another application found for laminated plastics in the laboratory is for instrument panels. Here the outstanding electrical characteristics of the laminate are of the greatest value. A typical high grade paper laminated sheet for insulation work has a volume resistivity (megohms/cm³) 10^7 – 10^8; surface resistivity (megohms/cm²) 10^6 – 10^7; power factor at 800 cycles (per cent) 1.5 – 3.5; dielectric strength at 90°C. (volts/mil.) 200-400; dielectric strength at 20°C. (volts/mil.) 400-600; breakdown along laminae at 90°C., 30-40 kV and dielectric constant 5.4-5.7.

In addition, this material possesses good mechanical strength, having 90 per cent of the tensile strength of aluminium, although only one-half the specific gravity. The laminated panels can be cut with a bandsaw or circular saw, drilled, turned and machined as readily as non-ferrous metal or hard wood.

One of the newest laminates consists of a glass fibre reinforced material, which is specially suited for use in electric motor armature end laminations and slots sticks because of its ability to retain its physical properties at high temperatures. Other uses are as switch washers, control switch plates and field coil end washers.

Perspex acrylic sheet, which is clear and transparent, is available in thicknesses from 1/25 in. to 1 in., and is finding many uses in the laboratory for the construction of apparatus. It is a tough, thermoplastic material, which softens at a temperature which is conveniently low for fabricating and working, but is sufficiently high to enable shaped articles to be used for many scientific purposes.

Sheets of Perspex can be cut with an ordinary carpenter's saw, or a band or circular saw, and machined with equipment normally used for woodworking. Cementing can be carried out very successfully by use of a solvent, such as chloroform, ethylene dichloride or glacial acetic acid, or a proprietary cement. The strength of cemented joints is excellent, and tensile tests have shown that they do not fail along the cemented surfaces, and that a fracture usually takes place at about two tons per sq. in., which is about half the normal ultimate tensile strength of the material.

In the chemical laboratory there is a growing need for a constructional material with all the optical properties of glass yet without its fragility and difficulty of fabrication. Acrylic sheet fulfils these requirements, with the proviso that it is not as a general rule safe to expose it to a temperature exceeding 75°C. Moreover, direct flame must never be allowed to play upon its surface as the material is, itself, inflammable, combustibility being rated about the same as hardwood.

Perspex is completely resistant to water, dilute acids (10 per cent nitric, 31 per cent hydrochloric acid, 50 per cent phosphoric, 25 per cent sulphuric, 50 per cent acetic and 25 per cent formic) and concentrated solutions of alkalis. No effect is noticed when this plastic is exposed for long periods to many of the common gases, including ozone and sulphur dioxide, but chlorine, particularly if moist, attacks the surface. Perspex is attacked by liquid hydrocyanic acid and solutions of chromic acid above 40 per cent chromic oxide. A number of organic solvents dissolve or soften acrylic resin and these are mainly of the aromatic hydrocarbon, ester, ketone or chlorinated hydrocarbon class.

Differing Rates of Expansion

In making laboratory apparatus out of Perspex, it is advisable to take some precautions in fitting and installation of the parts made of the sheet. For example, the coefficients of expansion of Perspex and metals are so widely different that allowance must be made for the relative movement of the Perspex when fitted in metal mountings. This plastic changes its length by 0.8 per cent over a temperature change of 100°C.

It is possible to calibrate Perspex vessels by engraving, sand blasting, embossing, printing or painting. By using hot tools, it is quite easy to die-stamp designs, etc., on to the cold sheet. For purely temporary marking, grease pencils have proved satisfactory, but care needs to be taken to remove pencil marks before

heating, as otherwise the sheet will be stained.

In the biological laboratory, Perspex is of considerable value as it is such a convenient material for making many types of experimental apparatus, *e.g.*, containers for entomological research. Transparent acrylic sheet is a favourite material for constructing rearing chambers for house flies, *Musca domestica L.*, and other insects in order to evaluate insecticides and repellents.

The physicist uses Perspex for building many types of electrical apparatus. Here the excellent insulating characteristics and good mechanical properties combine to make it very suitable for constructing prototypes of new testing apparatus. It is surprising the number of uses this material finds in the modern physical testing laboratory.

Aspherical Plastic Lenses

Various types of optical systems, some of them embracing the use of aspherical lenses, can be produced in acrylic plastics by novel casting methods. Inspection lenses are now being manufactured which employ these very accurate aspherical plastic lenses, which are able to reduce eyestrain imposed by close work. Crystallographers will find these new magnification lenses of considerable value.

Biologists, pathologists, entomologists and other scientific workers make use of acrylic resin for embedding specimens. In principle, the method is simple, consisting of immersion of the specimen in methyl methacrylate monomer or syrup. When this is very slowly heated in an oven for several days at 40° C. polymerisation takes place and the specimen is then firmly embedded in a transparent block of resin. This can be polished and mounted if required. Although the principle of the method is essentially simple, in actual practice it is difficult to achieve perfect specimens without a good deal of experience. The secret of success is to carry out polymerisation very slowly. Polyester resins can also be used instead of the acrylic for embedding work.

Most laboratory workers are now familiar with blown polythene bottles, beakers and other types of containers for holding highly corrosive fluids, such as hydrofluoric acid. These vessels are light (0.92 at 20° C.) and yet virtually unbreakable. The melting point of this thermoplastic is 110-120° C. and it is not recommended for use at temperatures exceeding 65° C.

Polythene may be obtained in sheet form. This is sold in varying thicknesses; 1/16 in., 1/8 in. 3/16 in., ¼ in. and ½ in., and in one size only, 30 in. by 30 in. The sheet is available in natural or black, the latter containing a small percentage of carbon black. For lining tanks and making various kinds of large containers, it is possible to use either gas- or electrically-heated welding torches. By using these torches, sound welding can be achieved.

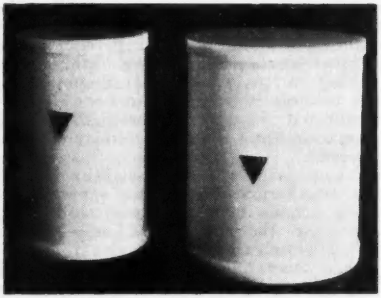
For containers and vessels the laboratory worker can provide spouts and handles made from polythene tube and welded to the container. Large unsupported vessels may be made from the thicker sheet and, if necessary, external straps of metal can be used at intervals to give reinforcement.

Polythene sheet cannot be cemented to the tank, and the lining therefore has to be of the loose type. It is, however, important that the lining should fit the tank exactly so as to ensure that the hydrostatic load transferred to the tank does not result in excessive tensile stress in the lining. No allowance is normally necessary for the relative thermal expansion of the polythene as the pressures of the enclosed liquid will prevent buckling of the sheet.

Extruded polythene tubing is now being used for water service lines and for conveying corrosive fluids. It is particularly useful for both mineral and organic acids, caustic alkalis and solvents up to 60° C. Unlike rubber, this thermoplastic remains

[Courtesy of Rediweld, Ltd., and I.C.I., Ltd.

One-gallon bottle made of polythene



Other forms of chemical containers by Rediweld, Ltd.

flexible down to as low as −70°C. for the tougher grades of polymer. Large diameter tubes and ducts can be readily fabricated from sheet by wrapping it round a wood former and then welding the seam, using hot gas and a polythene filler rod.

The new rigid or unplasticised grade of polyvinyl chloride possesses a high degree of chemical resistance and very satisfactory mechanical strength, including outstanding impact strength and good electrical properties. Although these properties of PVC are somewhat inferior to those of polythene, the PVC has the advantage of possessing a rigidity greater than polythene and similar, in fact, to wood. Unlike polythene, the rigid grade of PVC can be cemented with special solvents, and this makes for greater ease of fabrication. Welding can also be carried out using special techniques.

PVC and Polythene

PVC sheet is available in sheet sizes similar to those offered for polythene. The softening point (vicat) of this material is 90-95°C., and it is generally recommended that vessels, pipes, etc., fabricated from PVC sheet should not be exposed to working temperatures in excess of 55°C. PVC is non-inflammable, whereas, of course, polythene is fairly readily combustible.

Polytetrafluoroethylene is an outstanding new thermoplastic of great interest to research workers who require a material for making gland packings, pipe jointing and valve seatings, also linings for tanks and other vessels which are able to resist chemical attack at elevated temperatures. PTFE possesses a number of quite unique properties. It is, for instance, chemically inert, thermally stable, non-toxic and possesses good mechanical properties and a low coefficient of friction.

Gland packings of PTFE meet the requirements of the most severe gland service conditions, being able to withstand the corrosive and solvent action of any known acid or chemical, even when they are handled at higher than average pressures or at temperatures as high as 450°F. or as low as −60°F.

When operating small distillation equipment for corrosive fluids, these PTFE packings are proving of exceptional value.

The silicone fluids (methyl polysiloxanes of varying chain length) are of interest to research workers who require water repellents, anti-frothing agents and low temperature lubricants which do not increase in viscosity to the same degree as petroleum based oils. Coatings of silicone of the order of 300 molecules thick can be "fixed" to glass by a simple baking process so as to leave the glass water-repellent.

The vapour of mixed methyl chlorsilones will achieve the same result when used in the cold. Concentrations of a few parts per million of silicone fluid will effectively prevent the frothing of oils and other compounds. Another silicone compound of interest to scientific workers is silicone rubber, which finds application as a packing and gasket. A recent and unusual use for this material is as a gasket for glass observation windows in refrigeration chambers. For this purpose use is made of an extruded silicone rubber gasket which is able to cushion large double sheets of plate glass for indefinite periods without loss of resiliency or deterioration due to chemical attack.

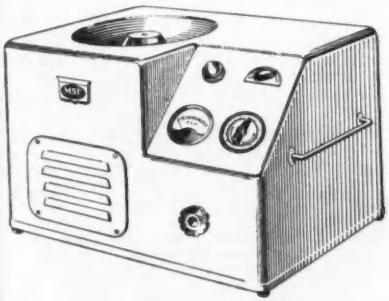
Manufacturers of small electrical appliances for laboratory use are showing an increasing interest in moulded nylon bearings, connecting rods and other moving parts. Weighing only one-eighth as much as metal, nylon provides the necessary strength, toughness and resiliency and, in addition, provides quiet operation either with no lubrication or with less than that required by other materials. In many cases, nylon offers cost savings over other materials on account of the ease with which it can be mass produced by injection mouldings, plus its lightness in weight and superior performance.

NEW LABORATORY INSTRUMENTS

Centrifuges and Visual Apparatus

THE MSE high speed angle, laboratory type centrifuge, has been specially developed by MEASURING & SCIENTIFIC EQUIPMENT, LTD., for the increasing number of centrifuging jobs which necessitate extra high centrifugal force for fairly large quantities of material. It should, therefore, be particularly welcome to scientists engaged in bacteriological or similar work where the specific gravity of the suspended matter is such that separation would be impossible or too slow when using the usual types of centrifuges.

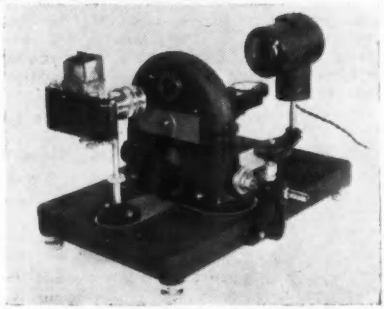
All controls on this instrument are conveniently grouped, there are no extraneous fittings, and a flexible mains cable is supplied for fitting to a 5 amp. plug. It is 17 in. (430 mm.) high, can be carried easily by means of the two handles provided, and is intended for bench use. Alternatively, and for even greater operating convenience, a low-wheeled trolley can be supplied. It has a maximum speed of 13,000 rpm, giving a maximum RCF value of 20,000 by gravity. One fully enclosed streamlined angle head (400 ml. capacity) is supplied which will carry 8 by 50 ml. tubes, or alternatively 8 by 7 ml. tubes (using sleeve adaptors).



MSE angle centrifuge

NOTABLE among modern instruments designed to meet the requirements of research in chemistry and related fields and believed to be novel in this country is the Neotron high-speed centrifuge (No. 106 A) of THOMSON, SKINNER & HAMILTON, LTD. This is claimed to give, in micro tests, a very much higher performance than other existing instruments.

The principal feature of this machine is an air-driven rotor with an aperture in which a (transparent) cell, containing the test sample, is inserted. At a maximum speed of 20,000 r.p.m. at the usual air pressure of 80 p.s.i. for which the centrifuge was designed, the tested sample is subjected to a centrifugal force equal to approximately gravity plus 26,000.



Neotron high-speed centrifuge

The special material of the rotor provides an ample safety factor at the maximum speed. Lower speeds can be secured by adjusting an air valve. The rotor shaft runs in precision ball bearings, mounted in a strong housing which safely encloses all revolving parts. Careful balancing of the rotor and the damping effect of the heavy-section base-plate ensure operation practically free from vibration. The r.p.m. can be checked by engaging with the extended rotor shaft the reliable tachometer provided. The rotor can be brought to rest within half a minute by means of a brake arrangement, fully enclosed and operated by a thumbscrew.

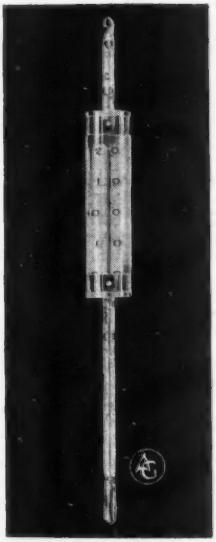
Photographic records of the test samples in various stages of sedimentation while the centrifuge is in motion, can be seen, a camera should be mounted on the adjustable bracket. By this means, sweep images are obtained of the samples under test. Sedimentation can be observed during running by fitting a ground glass screen to the camera in place of the 35 mm. film. Lighting is provided by a powerful projection lamp, mounted in the rear and focused on the cell through an aperture in the housing. Four cells of various capacities up to 0.35 ml. are supplied as standard with the centrifuge machine.

A PHOTOELECTRIC colorimeter (or absorptiometer) which A. GALLENKAMP & CO., LTD., has developed is designed to to offer all the advantages of modern photoelectric colorimetry at relatively low cost, without sacrifice of analytical precision. The instrument is neat and portable (about 8¼ lb.) and is suitable for use in general analytical and clinical laboratories. It is a deflectional type instrument in which the ratio of absorptions of different solutions are indicated directly from scale readings, it being assumed that Beer's Law holds for all concentrations compared in this way. The circuit is designed to maintain linear response to light intensity. Coarse and fine controls give quick and easy adjustment for zero setting. A "safe" position is available for filter changing and to make the instrument safe for transport.

Gallenkamp photoelectric colorimeter

Designed for users requiring a reliable and safe—it having no exposed heads—yet inexpensive centrifuge to take tubes up to 50 ml. capacity, is a junior model by A. Gallenkamp & Co., Ltd. This has a maximum speed of 3000-4000 r.p.m., depending on the head used. It is precision built throughout from the finest materials and components, the makers claim. The action is fully floating on rubber bushes and the whole is mounted in a base casting, which also encloses a speed controlling rheostat with incorporated switch.

Listed as a new laboratory aid is the thermometer reader by A. Gallenkamp & Co., Ltd. This consists of a transparent plastic cylindrical lens with engraved index line. It fixes to the thermometer stem by means of spring clips, and will fit most solid stem chemical thermometers. It magnifies approximately 2-in. of the scale and allows the thermometer to be read at considerable distance.



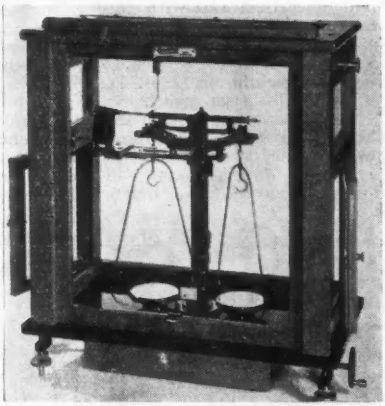
Gallenkamp thermometer reader

The Jackson Thermoregulator, also by A. Gallenkamp & Co., Ltd., is a mercury-in-glass electrical instrument intended primarily for laboratory use, but is applicable wherever fine temperature control is required. It is claimed to be free from the defects of the toluene regulator. To raise the range of the thermoregulator, mercury is transferred from the bulb to the annulus and *vice versa*.

Gallenkamp junior centrifuge

AN entirely new precision weighing instrument has recently been introduced by L. OERTLING, LTD., London. This aperiodic null-point chainomatic balance (model No. 101) is a modification of the company's well-established 48 GC type. The new balance has a sensitivity of 1 mg. and a capacity of 200 gm. in each pan. The aperiodic device employs a permanent magnet and metal vane fitted to the left-hand end of the beam. The magnet can be easily withdrawn to provide a normal free-swinging instrument.

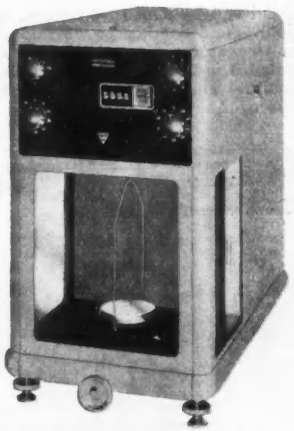
The ideal analytical weight should be made of hard metal which is corrosion resistant to both oxidising and sulphur fumes and is non-magnetic. Nickel-chromium weights made by Oertling are claimed to be more durable than other metals. They are, of course, non-magnetic and adjusted to meet the specification of tolerance set up by the National Physical Laboratory. Fractional weights included with the nickel-chromium analytical weights are made of nickel-chromium wire down to 0.01 gm.



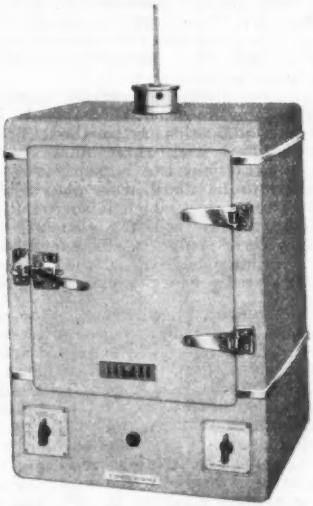
Oertling chainomatic balance Model 101

THE basic design of the balance has remained the same for many generations—a beam and two pans. With its model 200, J .W. TOWERS & CO., LTD., has introduced a radical change of design, namely, a single pan balance. This design achieves, in particular, constant sensitivity and constant load. It eliminates beam length errors, reading errors, and errors due to corroded or worn weights. It is claimed to be the most easily and rapidly operated balance made.

All weights from 0.1 to 199.9 gm. are operated from outside the case by means of four control knobs. There is thus no weight handling and no wear and tear on the weights. The load on the beam is brought to 200 gm. on every weighing by removing weights equal to that of the sample. The total of these weights is indicated on the direct reading scale. The weight less than 0.1 gm. is shown optically and automatically on the illuminated

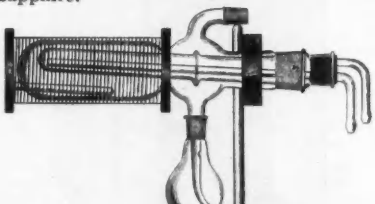


Towers automatic direct reading balance Model 200



Towers universal electric oven

scale and can be read to 0.1 mgm. (half a division). The balance is air-damped and comes to rest quickly. The capacity of the balance is 200 gm. and the sensitivity 0.1 mgm. The planes are of synthetic sapphire.



Towers sloping condenser molecular still

The Towers universal oven is constructed of sheet steel, cream enamelled, with stainless steel interior. It is lagged with glass silk insulation and fitted with thermostatic control 0-180° C. or 0-300° C. with individually calibrated dial in degrees Centigrade. For uniform heating and safety the elements are placed at the bottom and sides of the oven and are totally enclosed.

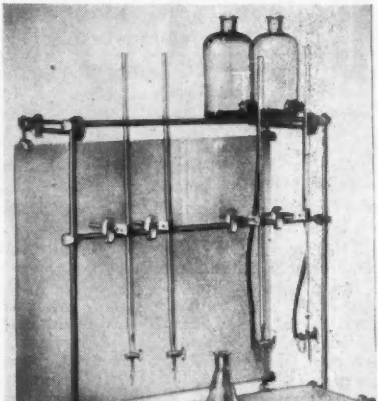
The Towers sloping condenser molecular still, designed by A. R. Gilson, M.A., is for distilling quantities up to about 100 gm. and is fitted with three flasks so that different fractions can be separated. The material to be distilled is placed in the part of the vessel which is surrounded by a Nichrome tape heating element, which permits clear visibility. The temperature can be controlled over a wide range by means of a transformer energy regulator.

AN air-damped micro balance, for which an exceptionally high degree of accuracy is claimed, has been perfected by STANTON INSTRUMENTS, LTD. This instrument, the M.C.1/A, offers easy accessibility to the pans, and provides external manipulation of weights up to 100 mgm. The ring rider weights used are of nickel-chrome wire—an extremely corrosion resisting, non-magnetic material. The new projection screen enables readings to be taken more easily. The graticule is divided into 200 divisions, each representing 0.01 mgm.

Although the claimed sensitivity of the instrument is 0.01 mgm., many microchemists are said to have found that estimations to within 3 micrograms can be made, since the divisions are fairly wide. The beam is of special lightweight construction giving added sensitivity. The balance has a separate beam chamber to reduce influence of heat and air currents on the beam. Very little heat is generated by the small low-power projection lamp, while illumination brightness is maintained at a maximum by means of a special lighting system and of the totally enclosed mirror housing.

CURRENT laboratory equipment by W. & J. GEORGE & BECKER, LTD., in its Nivoc range, includes a new modified dip circle, which replaces the previous apparatus No. 16591. This now has a 6-in. (15 cms.) circular moulded base marked with four index lines at right-angles. The 5-in. (13 cms.) diameter dial is graduated and has an anti-parallax mirror. The needle mounting (of unit construction) rotates about a vertical axis with needle bearings of synthetic sapphire. The dip circle is supplied with two needles, one magnetised and the other unmagnetised. The apparatus has a height of $7\frac{3}{4}$ in. (18 cms.) and weighs $1\frac{1}{4}$ lb. (600 grm.).

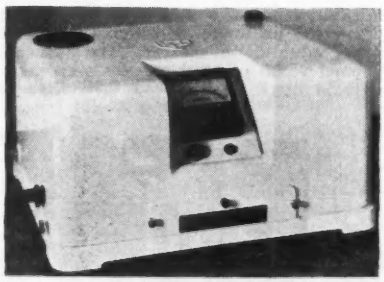
The Nivoc anti-vibration table (W. & J. George & Becker, Ltd., absorbs high and low frequency vibrations in the horizontal or vertical direction and will make possible the accurate use of balances in places



Kemiframe titration bench by W. and J. George and Becker, Ltd.

which would otherwise be impracticable. Vibration in those parts of laboratories or works where accurate measurements must be made will rarely approach such severity that the Nivoc anti-vibration table will not absorb it. Any balance with a total weight of up to 40 lb. can be used successfully on the table.—**BIF, Stand C 61, Olympia.**

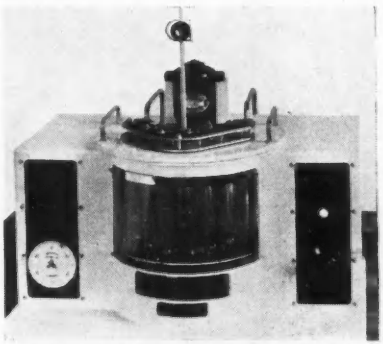
THE research and development division of BAIRD & TATLOCK (LONDON), LTD., has recently developed a number of new items of laboratory apparatus. One of these is the B.T.L. self-balancing photoelectric recording absorptiometer. This instrument, produced in collaboration with I.C.I., Ltd., and to which much of the development work is due, was required originally to detect small colour changes in a liquor used in a chemical process, and to provide a continuous quantitative indication of these changes on a recorder. With suitable colour filters the instrument may be calibrated to record the composition of any liquid absorption of which can be related to some some of chemical analysis or turbidity.



Baird and Tatlock self-balancing photoelectric absorptiometer

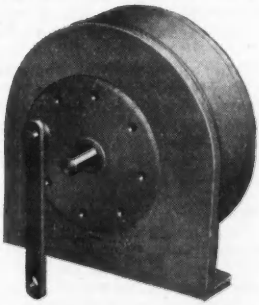
Another new instrument is the Preston density comparator, made exclusively for the British Hartford-Fairmont Syndicate. It is used as a comparator in the process control in glass manufacture. The method involves the settling of lumps of glass in a mixture of heavy liquids. This is done in a water bath by means of a constant rate of heating of the liquid. The temperatures are read at which the unknown and the known lumps pass a reference level in a tube of heavy liquid. The densities of the unknowns are then determined, from that of the known, by means of pre-determined coefficients.

Of particular interest to agricultural chemists and soil physicists is the development of the gypsum absorption cells for the determination of soil moisture content. These cells provide a response from which may be obtained a continuous measurement of soil moisture over the range which is critical to plant growth.—**BIF, Stand C57, Olympia.**



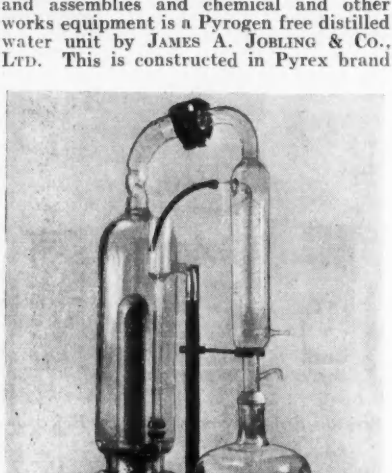
Preston density comparator by Baird and Tatlock

THE Unilag rotary time delay, by UNILAG, LTD., is claimed to be the only rotary type being produced and is stated to have opened up fields of use not possible with the ordinary rack and pinion operated type. Although primarily intended for use on electrical switchgear, etc., its application is not confined to electrical units, being suitable to any mechanism where a pre-determined delay, with or without a quick drop or free movement at the end, is required. All moving parts are load-tested on assembly and, being totally enclosed, are stated to give long and trouble-free service, unaffected by changes in climatic conditions. It is claimed to be an entirely new conception in time delays, designed to give continuous protection, control or regulation.



Unilag rotary time delay

ILLUSTRATING the numerous increasing uses of glass in laboratory apparatus and assemblies and chemical and other works equipment is a Pyrogen free distilled water unit by JAMES A. JOBLING & CO., LTD. This is constructed in Pyrex brand



Pyrogen free distilled water unit by Jas. A. Jobling and Co., Ltd.

glass and is electrically heated by a glass immersion heater; it will yield some 3.5 litres per hour. Included in the large range of glassware produced by Jobling's is a spray cooler having over 200 ft. of 1-in. bore tubing, also a circulating evaporator which is capable of evaporating under full vacuum some 12-14 litres per hour.

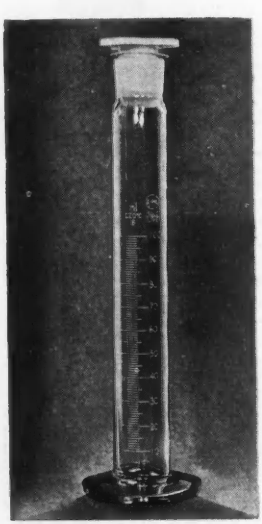
This firm specialises in the production of a complete range of Pyrex brand glass pipelines with precision bores, which are available in long lengths, also many improved patterns of ground glass joints to British Standards specifications.—**BIF, Stands S17 and S24, Earls Court.**

NOTEWORTHY among recent improvements in design and construction of laboratory glassware and apparatus are a number of products of H. J. ELLIOTT, LTD. These include thermometers employing a special type of gold-enamel-back glass tubing, which greatly facilitates readings made in indifferent conditions of lighting. This is produced by the contrast of the mercury column and black figuring and scale divisions with the yellow background.

Among the current productions of this firm are Nessler glasses for colour-comparison work. These are strictly to British Standard specification and are available in matched sets of ten. The base of each glass is shadowless, thus eliminating "dark spots" and distortion of transmitted light.

An item recently introduced by this firm is a glass measuring cylinder, with increased width of neck—making for faster pouring and easier cleaning after use—and patented "E-Mil" plastic stopper. A feature of Elliott glass apparatus is the exclusive chemically resistant coloured fillings in the gradations. Certain price reductions have recently been announced by this firm.

H. J. Elliott, Ltd., has recently evolved a new thermometer background in "gold" instead of the traditional white treatment. Against this background the mercury column shines with considerably increased brilliance and the definition of the graduations is clearer. The new thermometer can be read quickly even in uncertain light.—**BIF, Stand C.29, Olympia.**



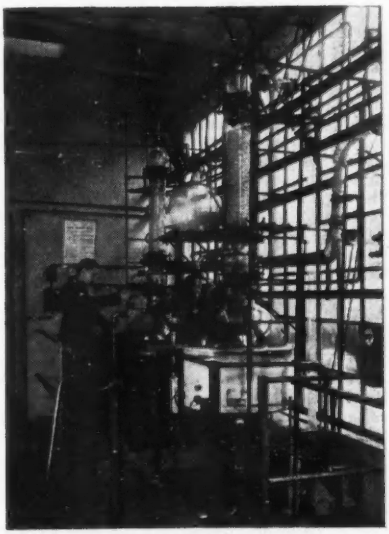
Measuring cylinder by H. J. Elliott, Ltd.

ONE of the largest operations in the production of optical instruments has recently been successfully completed by CHANCE BROTHERS, LTD. This is a large telescope disc for an American university. Made of dense flint optical glass, it is 25 in. in diameter and almost 4 in. at its thickest edge. It will be despatched to the U.S.A., where the surfaces will be ground and polished for use in the objective of a new Schmidt type telescope. The sequence of operations necessary for the production of this disc have occupied eight months. A special melting of glass of just the required composition to give the necessary refractive index had to be rendered homogeneous by stirring, being then cast into a large block weighing about half a ton.—**BIF, Stand C32, Olympia.**

A RECENTLY developed version of the standard AvoMeter of the AUTOMATIC COIL WINDER AND ELECTRICAL EQUIPMENT CO., LTD., has a sensitivity of 20,000 ohms per volt on the d.c. voltage ranges and 1000 ohms per volt on the a.c. ranges. The millivolt drop on d.c. current ranges does not exceed 500 mV. This is a compact and portable electrical measuring instrument for which many advantages are claimed which commend it for use in laboratory or workshop. A 5-in. clearly marked scale with an anti-parallax mirror is used for 25 ranges of readings.

THE microptic measuring machine (horizontal pattern) of HILGER & WATTS, LTD. (Watts Division), measures external and internal plane, cylindrical or threaded diameters direct to 0.00005 in. and by estimation to 0.00001 in. It has a range of measurement 0 to 4 in. and a capacity of 0 to 14 in. on external, and 7/16 to 10 in. on internal measurement. The measuring head is identical with that of the Watts vertical measuring machine, the accuracy of measurement being dependent on a precision-divided glass scale and not on mechanical parts. The bed is very sturdily constructed, and is provided with three levelling screws and a circular bubble. The measuring column is supported at both ends to eliminate risk of distortion. The work table is adjustable for height, and can be tilted and rotated. The instrument is supplied with a number of interchangeable measuring contacts for various classes of work, and specially designed work tables.—**BIF, Stands D319 and 216, Birmingham.**

The new series of precision scales made by Hilger & Watts, Ltd., is stated to rival the long used celluloid-edged boxwood scale and to be likely eventually to supersede it, since the price is lower. Each scale in the series is a carefully made reproduction of a precision-divided master scale, the dividing equipment used being the same as that used for lino standards, also produced by this company.—**BIF, SCIEX Stands Nos. C56, 57 and 58, Olympia.**



A large-scale operation in glass by Quickfit and Quartz, Ltd. Reaction under reflex unit assembly in semi-technical laboratory with 100-litre capacity

LABORATORY equipment currently made by GRIFFIN & TATLOCK, LTD., includes a number of new and interesting items. A concentric tube vacuum manometer represents a compact, easily refilled design for use in measuring gas pressures in the range 1-100 mm. of mercury. In the measurement of these sub-atmospheric pressures the manometer will appeal to those who have felt the need for a simple, robust, compact mercury-type instrument. The makers state that it will find immediate application in the chemical laboratory in organic distillations, in evacuation of desiccators and in the measurement of filtration processes.

New fractional distillation apparatus for laboratory use is being made by Griffin & Tatlock to the basic designs of the Anglo-Iranian Oil Co., Ltd. In designing these columns close attention has been paid not only to their theoretical performance and efficiency, but also to the ease of erecting them, of operating and of maintaining them. The glass parts are

firmly supported, yet sufficiently flexibly mounted to ensure freedom from strain under thermal expansion. The boiling flask is easily accessible and interchangeable. Dixon gauze rings made by this firm are a new random packing for laboratory scale fractionating columns. Their high efficiency is stated to be achieved by using small gauze rings of Lessing shape and completely sealing the apertures of the gauze with the reflux liquid. A completely wetted surface is thus maintained throughout the fractionation, with an entire absence of visible channelling or drip.

THERE have been many developments, both in all-glass laboratory apparatus and in industrial plant in glass by QUICKFIT & QUARTZ, LTD., including new apparatus developed since last year's British Industries Fair.

Laboratory glassware to be shown at the BIF and elsewhere shortly will include many assemblies, such as the Stadler still, reaction with stirring, steam distillation, vacuum fractionation, moisture determination, and chromatographic absorption. A new feature of interest is the "Utility" set, illustrating the versatile unit principles fundamental to the company's equipment.

Examples of industrial plant in glass stress the value of its non-corrosive properties and transparency. That is leading to its increasing employment for the production and absorption of acids, processing of rubber, manufacture of dyestuffs, rayon, concentrated and dehydrated foods and distillation in all its aspects, including valuable applications in the field of drug and fine chemical manufacture.

Exhibits which have been prepared for the BIF include a 100-litre combined reaction and distillation assembly, a typical continuous vacuum fractional distillation plant, reflux heads, packed column sections, a continuous vacuum receiver and several of the glass heat exchangers.

AMONG the many instruments and items of apparatus applicable to the chemical and related industries produced by the GENERAL ELECTRIC CO., LTD., is one of frequency stabilisation by molecular resonance. This apparatus provides a method by which the frequency of an oscillator may be stabilised. It depends on the fact that in some gases at low temperatures there is strong absorption of electromagnetic waves due to molecular resonance. Ammonia, for example, has been found to show strong absorptions for wavelengths in the region of 12 mm.

G.E.C. has produced a Geissler type of

G.E.C. apparatus for the measurement of a magnetic field by means of the Hall effect in germanium. The germanium crystal is in the foreground

cold cathode discharge lamp in which the mercury isotope ^{198}Hg is used as the exciting element with an inert gas (neon or argon) as the carrier. The light emitted is of a very high monochromatic quality and the lamp can be used as a wavelength standard or for any application in which the absence of fine spectral structure is important. Four types of germanium crystal rectifiers for use in electronic circuits, indicating instruments, telephone apparatus, etc., have been introduced by The General Electric Co., Ltd., and are available for immediate delivery. The rectifiers are very small in size, have low forward impedance and are designed to be soldered directly into a circuit so that no mounting or support is needed. Their life should be not less than that of equipment in which they are used. **BIF, Stand C503 and 402, Birmingham.**

THE Foxboro Dynalog (Foxboro-Yoxall, Ltd.) presents an entirely new conception of the electrical bridge, self-balancing type of instrument. By advanced electrical methods such conventional mechanisms as slide wires, galvanometers, rotating balancing motors and standardisation checks, are eliminated.

In these instruments the measured electrical quantity (resistance, emf, *p*H, conductivity, etc.) is part of an a.c. bridge circuit and a detector circuit performs the functions of the conventional galvanometer. Electrical out-of-balance is amplified electronically, dispensing with the older galvanometer movement multiplication mechanisms.

Instead of a stepwise slide wire there is a smoothly operating Dynapoise drive, a solenoid motor, which serves to adjust a

variable capacitor to restore electrical balance in the bridge. Up to six differently coloured records may be obtained upon a circular chart using a single pen arm. The marking frequency is one point in six seconds and continuous records can be obtained on a 24 hour chart. The Dynalog can be used for multi-point indication, using key pattern or rotary switches, and is also available as a primary measuring system for automatic control.

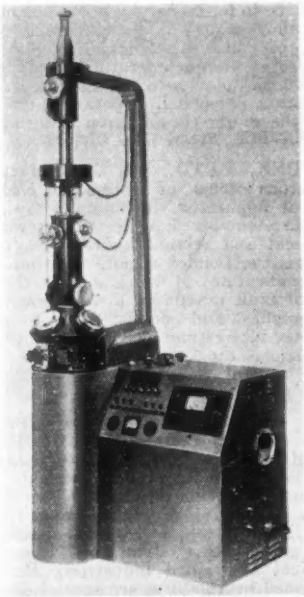
AN important means, in a newly available form, for widening the range of much laboratory work is represented by the Finch-type electron diffraction camera. This seems likely to gain wide acceptance as a powerful research tool for the investigation of surface phenomena, for example, the structure of thin films, surface layers of materials, metallic oxides and compounds, corrosion, plating, lubrication, metal-to-rubber bonding, etc.

The instrument illustrated is by W. EDWARDS & CO. (LONDON), LTD., which acknowledges its direct connection with the successful research work of Prof. G. I. Finch, augmented by development work in the firm's own research department. It is claimed that it combines scientific accuracy and dependability with the ready accessibility of controls expected by the practical operator.

The makers point out that much depends on the design of the source of electrons; in this instrument the cold cathode discharge is used with the Finch-type high tension circuit to give reliability with stability and robustness. Under operating conditions, *i.e.*, with accelerating voltages between 30 and 70 kV, quite a simple circuit is stated to suffice to maintain stabilisation, in order to obtain a monochromatic electron beam, and a high standard of definition.

With the aid of the split-plate shutter of this camera, the specimen under investigation can be photographically recorded side by side with a standard substance of known diffraction pattern, for subsequent comparison of the two records. This, it is pointed out, avoids the need for absolute measurement, as it gives an accuracy equal to that of X-ray diffraction.

High vacuum equipment by W. Edwards & Co. (London), Ltd., for the chemical and other fields, includes a range of rotary vacuum pumps. To provide suitable backing pumps for the larger diffusion units, the Speedivac range of mechanical pumps has been extended by the single stage model 1S450A having a displacement of 15 cu. ft./min. (450 litres/min.) and ultimate vacuum of 0.005 mm. Hg.



Electron diffraction camera by W. Edwards and Co. (London), Ltd.

(McLeod gauge). Its features include an integral spray arrester, oil level indicator, easy drainage facility, small oil supply, quiet valve, and light alloy construction.

This firm's range of oil diffusion pumps now includes a 16 in. diameter four-stage unit having a speed of 5000 to 6000 litres per sec. This, like all the pumps in the range beyond 1-in. size, incorporates an integral booster stage to reduce the size of the backing pump and associated pipelines. A self-purifying metal pump by W. Edwards & Co. (London), Ltd., operates with an interesting new fractionating arrangement and is capable of attaining ultimate pressure of the order of 10^{-7} mm. Hg. The pump is 2½ in. bore, has a speed of 70-80 litres per sec. and a maximum backing pressure of 0.5 mm. Hg.—**BIF, SCIEX Stands Nos. 56, 57 and 58, Olympia.**

THE Cintel industrial electronic metal detector, made by CINEMA-TELEVISION, LTD., is an automatic inspection equipment for the detection of metal inclusions in many industrial productions, including plastics, chemicals, toilet preparations, rubber, etc. One of its advantages is stated to be that it gives protection to processing machinery. The equipment is

sensitive to ferrous and non-ferrous metals, and alloys and will detect minute pieces. Use of automatic stabilising circuits assures maximum operating stability and is claimed to remove the need for skilled operating personnel. Operating costs are low, the power consumption being only 60 watts.—**BIF, Stand C49, Olympia.**

LONDEX, LTD., is manufacturing numerous items of automatic electrical control apparatus, including relays, and remote controls having applications in chemical and related industries. Among these is the Londex remote flow indicator, the applications of which include the control of tank overflows, distant water and oil supplies, and cooling water to plant. Another interesting piece of apparatus by this firm is the Lectralevel floatless liquid level control system.—**BIF, Stand C724, Birmingham.**

THE specialities of BARLOW-WHITNEY, LTD., cover a wide range of electrically heated plant and apparatus for industrial processes in many trades, vacuum and pressure impregnating plants, industrial ovens (for drying, stoving, curing, etc.), a humidity test cabinet, hot oil circulators, and many other items of interest to chemical and allied industries. Recently developed by this firm are special electrically heated pots and tanks for plastic dip coating processes, which are now being widely adopted for the protection of machined parts, tools, etc.—**BIF, Stand C210, Birmingham.**

A COMPLETELY new range of Megger testers, known as the Series 4, has been introduced by EVERSHED & VIGNOLES, LTD. The new instruments are housed in black plastic cases, 7¾ by 5 by 5¾ in., and have spring terminals. They are light in weight, easily portable and entirely self-contained. Their scale ranges are moderate, and they incorporate in a small instrument certain features hitherto available only in larger and more costly models. The new series of instruments includes insulation, continuity, earth and earthometer testers.

The Series 4 insulation tester, which has a scale range up to 50 megohms for testing at pressures up to 500 V., incorporates a constant pressure generator ensuring steady readings when testing cables having electrostatic capacity or circuits fitted with suppressors, a refinement previously only available on more expensive instruments in aluminium cases. The new tester can be fitted with a switch to divide scale readings by 100, or alternatively to have a second scale for continuity readings of 0-100 or 0-10,000 ohms according to need. Other features also available at extra cost, include a live line detector to protect the instrument during continuity tests on live circuits, and a dial illuminating attachment.

The Megger earth and earthometer testers, Series 4, are twin range instruments having scales of 0-40 and 0-200 ohms, or if preferred, 0-100 and 0-500 ohms. The earth tester determines the resistance to earth of earth electrodes, and the earthometer tester, which has a live line detector and special switch, measures with safety the impedance of complete earthing circuits, including the resistance of the sub-station electrodes and those at the consumer's premises.

THE modern instruments produced by the BRITISH THOMSON-HOUSTON CO., LTD., include a small mass spectrometer vacuum leak detector. This has its own vacuum pumps and electrical equipment comprised in a trolley cabinet, and has been designed for use under industrial conditions. The spectrometer employs 180° magnetic focusing and is of the cold-cathode type, ensuring long life and eliminating the need for a refrigerated trap; a.c. mains and cooling water are the only supplies required. Leaks as small as 10^{-5} litre micron per sec. can be detected.

Various lamps designed to provide powerful sources of radiation of definite wavelengths for laboratory measurement purposes are produced by the B.T.H. Co., Ltd. Some of these applications require a constancy of lamp output of a high order.

The BTH magnetic field strength meter employs the Hall effect in germanium. A small flake of germanium ⅛ in. by 1/16 in. by .015 in. thick is mounted in a probe, and thus can be used to explore and measure field strengths in very small gaps. The method is of greatest use where a certain orientation is known to be preferred; then the section to be examined can be chosen so that (100) planes are expected and inspection shows whether this is indeed the case.—**BIF, Stand C511 and 410, Birmingham; C106, Olympia.**

AMONG the recent laboratory equipment and instruments produced by the BALDWIN INSTRUMENT CO., LTD., is the Gamma radiation detector, Type PP. This is a compact, portable Geiger-Müller counter designed primarily for prospecting. It is also suited for finding lost radium in hospitals and laboratories and for demonstrating radioactivity in schools. A low voltage G-M tube and cold cathode valve amplifier are used to ensure long life of the dry batteries. An indicating instru-

ment with approximately logarithmic calibration is also incorporated in the hermetically sealed case. A socket is provided for headphones to give audible signals at very low counting rate. The instrument is fully "tropicalised".

A fountain-pen type pocket ionisation chamber, made by the Baldwin Instrument Co., Ltd., is for measuring the stray Gamma or X-radiation received by individuals exposed to such radiations. as in radio-therapy, diagnostic or industrial radiography departments and radiation laboratories. The chamber is hermetically sealed and desiccated to protect the insulator from dust and moisture. A diaphragm is provided for contacting the highly insulated centre electrode.

The Baldwin-Farmer protection electrometer is a compact valve electrometer for use in conjunction with the pocket ionisation chamber. Any number of chambers can be used with one instrument. Dry batteries used throughout have a useful life of several months even under continuous use.—**BIF, Stand C5, Olympia.**

A CONSIDERABLE widening of the field of usefulness of the normal moisture meter has been secured by MARCONI INSTRUMENTS, LTD., in their substantially modified **TF933** model. This instrument is designed for application to granular, powdery and fibrous materials in the loose form or in thin sheets, at moisture contents within the hydroscopic range. On its release in 1949, calibrations were available for a limited number of substances, mostly cereal grains. To-day, however, the instrument can be successfully used on a much wider range, including such materials as dried seaweed and alginates, gelatin, glue and isinglass. Calibrations have been established for textile fibres and fabrics including cotton, jute, wool, fur and viscose and acetate rayons. Although manufactured chemicals and inorganic materials are not usually suitable, the instrument gives excellent results in the testing of welding rod coatings.

THE Kelvin absolute pressure gauge (the KELVIN & HUGHES group) is designed to measure the absolute pressure of a gas by admitting it into a flexible metal capsule whose deflection is determined by a suitable linkage and gear train. Compensation of variations in the ambient pressure is secured by introducing the movement of an evacuated capsule unit into the linkage system. To achieve this, the compensating capsule is carried on a fixed platform below the pressure sensing capsule, the latter carrying a lever, one end of which is pivoted to a rigid member from the centre

Kelvin and Hughes absolute pressure gauge

of the compensating capsule, the other end being connected via a pivoted link to a crank arm carried on the input shaft of the gear train.

This instrument can be compensated to cover all normal variations in atmospheric pressure and over a temperature range of 50° C., say, 0° C. to + 50° C. Accuracy is stated to be better than 1 per cent of the scale range of 400 mm. Hg. chosen to be anywhere in the range 0-2 atmospheres. A two-pointer presentation is employed, the sensitive pointer making one revolution per 100 mm. Hg. change. The instrument may find application in chemical engineering plant as a vacuum gauge and in engine test-bed work as a boost gauge.

ELECTROLYTIC conductivity measurement has been recognised as an essential process in many industrial plants and in power stations and waterworks. In chemical factories, one of its applications is in the control of manufacture of sulphuric acid, ammonia and other products. In waterworks, the principle is applied to the detection of salt in water supplies from the upper reaches of tidal rivers. The "Multelec" electrolytic conductivity recorders of GEORGE KENT, LTD., with their potentiometric principle and null method of measurement, are stated to be capable of recording or controlling any condition which, by the use of a suitable primary element, can set up a small electromotive force or a change in electrical resistance proportional to the condition.

Besides electrolytic conductivity measurement, the main uses to which these

instruments are put, and for which there are standard primary elements, are: temperature measurement and control, using thermocouples or resistance thermometers or radiation pyrometers, for all ranges up to 1800° C.; *p*H measurement and control, used in water purification in power stations for control of boiler feed treatment and in many chemical industries (open tank type and enclosed flow channel antimony-calomel electrodes and glass electrodes are used); CO_2 measurement for boiler houses and furnaces.

AMONG the many laboratory instruments and general scientific apparatus made by NEGRETTI & ZAMBRA its range of electrical temperature instruments is of current interest. Its Model E/650 is a 6-in. scale edgewise resistance thermometer indicator. This has an engraved scale and anti-parallax mirror, a die-cast aluminium case heavily enamelled black, with Bakelite bezel and with back plate or swivel bracket for projection mounting, or fitted with four studs for flush panel mounting. It is calibrated for nickel or platinum coil elements to any of the standard ranges. It is provided with test switch and standardising resistance, also two 2-volt 20 amp. hour accumulators.

Model E/600 by the same company is a 6-in. scale edgewise indicating pyrometer with automatic cold junction control, and has high resistance movement. It is calibrated for rare metal or base metal thermocouples to any of the standard ranges. The electrical resistance thermometer by this firm is suitable for temperatures between −200°C. and +540°C. (−330°F. and +1000°F.) and because a bridge circuit is used a range span of as little at 30°C. (50°F.) may be supplied with a 6-in. indicator.—**BIF, Stand D237, Birmingham.**

VITREOSIL apparatus by THE THERMAL SYNDICATE LTD., includes transparent specimen tubes for X-ray diffraction analysis; optical quality fused quartz prisms, lenses, discs, etc.; absorption cells for use in spectrophotometry. A further example of recent Vitreosil apparatus is the filtering and ignition crucibles. These are now used extensively in chemical laboratories as they enable both filtering and subsequent ignition to be carried out in the same crucible.

Single and two stage Vitreosil Umbrella jet pumps operate with backing pressure of about 1 mm Hg. and under such circumstances are capable of creating as low as 0.00002 mm. Hg. The necessary backing pressure can be satisfactorily attained by means of a Vitreosil mercury vapour fore pump operated from an ordinary water filter pump, which replaces the expensive mechanical type of backing pump. This arrangement of a single or two-stage umbrella jet pump used in conjunction with a fore pump is claimed to provide a very inexpensive and extremely efficient high vacuum system.

THE elimination of the vortices, which are practically inseparable from normal paddle stirred baths, by substituting a flat jet circulator head in the base of the instrument, thus giving straight line stirring, is one of the predominant features of the S.127 thermostat bath designed by TOWNSON AND MERCER, LTD. The bath, which has toughened plate glass sides, has a range of −10° C. (or lower) to 120° C. and provides accuracy of temperature control of ±0.03° C. at 50° C. or up to ±0.01° C. with electronic relay.

Another modern T. & M. instrument is the infra-red moisture tester which consists basically of a sensitive air damped balance with counter weight, and a single pan above the beam. This is enclosed in a separate aluminium walled chamber, and the weight is transmitted through a supporting rod via a narrow hole. Above the pan is positioned a powerful infra-red projection lamp. This has a specially shaped rhodium plated reflector which concentrates the beam on to the area of the pan, diffusing it so as to give an even coverage. The instrument weighs out a 5-gm. sample and indicates directly the moisture percentage.

The latest development by this company is the small compressed air turbine stirrer, Turbinia type 5, designed for pressures above 15 p.s.i. The air is led in down the hollow handle which also fits into any normal retort boss, so that the distance from the stand can be varied. The jet can be readily dismantled for cleaning. All the air has to escape from the annular ring round the chuck, so that no fumes can get into the rotor mechanism. The speed range is from 10-10,000 r.p.m.

Other up-to-date instruments by Townson and Mercer, Ltd., some of which the firm will be showing at the Canadian International Trade Fair, Toronto, include the Research model constant temperature bath, incorporating many new features; two new types of Even ovens which have a normal range from room temperature to 250° C. with specially open scale up to 110° C., and a special range from room temperature to 50° C. with very open scale —for use as anhydric incubator; a top drive macerater and the L.T. blowpipe, with five jets.—**BIF, Stand C4, Olympia.**

DESIGNED primarily for laboratory use and for the maximum utility, rectangular muffle furnaces, type M254, by WILD-BARFIELD ELECTRIC FURNACES, LTD., are effective for such work as incineration, burning off precipitate and the heat-treatment of small samples of metals and small tools. The maximum recommended temperature is 1000° C. (1832° F.), or for models fitted with an excess temperature cut-out 940° C. (1726° F.). Each is a self-contained unit having a counterbalanced door and refractory of the highest grade, and is being fitted with a built-in energy regulator for temperature control.

The Wild-Barfield laboratory tube muffles, type M94, are designed for analytical works laboratory applications, their uniformity of temperature and ease of control considerably simplifying operation and obviating errors which otherwise are liable to give incorrect results, the makers state. Coiled heating elements of heavy gauge nickel chromium alloy are employed to give a maximum temperature of 1050°C. (1922° F.). A hand-operated energy regulator type temperature controller is carried in the base, with requisite pilot lights. It is suitable for operation on 200/250 V. single phase a.c., or, with special equipment, on other a.c. supplies or d.c.—**BIF, Stand C321 and 220, Birmingham.**

ELECTRONIC valves and components increasingly employed in automatic operation control are receiving marked attention among the new products of MULLARD ELECTRONIC PRODUCTS, LTD. These include general-purpose valves on Octal, B.8A and B.7G bases; battery and mains subminiatures; VHF valves; industrial thyratrons; industrial photocells; stabilisers and voltage reference tubes; electrometers; instrument cathode ray tubes; and electronic flash tubes.

The range of photocells, in particular, has been specially developed to meet the needs of industry and research. Their wide field of applications includes counting and batching; sorting by various standards, such as size and colour; quality control; and the rapid and accurate inspection of mass-produced articles.

The thyratrons have a number of industrial applications, particularly in counting, timing, alarm and motor speed control systems.

Electrometer valves play an important part in high-resistance apparatus used in research, besides forming the basis of a variety of *p*H meters and valve voltmeters.

An important application of electronic flash tubes is the linear form used in the field of pure research for photographing ion-tracks in Wilson cloud chambers.

A new design of oscilloscope has been produced by Mullard, intended for a wide field of use, particularly in connection with nuclear research and television development. The instrument is built round a cathode ray tube with a useful screen diameter of 13 cm. and a blue-white trace suitable for visual or photographic work.

To help bridge the gap between fundamental discoveries in ultrasonics and their industrial exploitation was designed the Mullard ultrasonic generator. Methods available for generating ultrasonic vibrations depend on the medium which is to be irradiated. For liquids and solids only two methods are commonly employed, although alternative systems are being explored. These involve the use of magnetostrictive metals (which change their length in a magnetic field) and piezo-electric crystals (acted on by an electric field).—**BIF, Stand C69, Olympia.**

AMONG the wide range of chemical stoneware produced by DOULTON & CO., LTD., are numerous small items as well as storage vessels and tanks of several hundred gal. capacity. In certain types of plant, such as vacuum filters, pumps, absorption towers and pipe lines, the fired ware can be machined to obtain high dimensional accuracy and close-fitting faces and joints. Special bodies have been evolved to suit specific requirements, *e.g.*, stoneware with very low porosity or with very marked resistance to abrasion, heat and thermal-shock.

It is claimed that there is no material available for chemical plant construction that has such a high and universal chemical resistance as chemical stoneware. Only hydrofluoric acid (or certain volatile fluorine compounds) and caustic alkalis have been found to have any detrimental effects. With this high resistance to corrosion, the material combines strength, rigidity, chemical inertness, and resistance to abrasive slurries. Chemical stoneware is extensively used in the manufacture of a wide range of chemicals, explosives, pharmaceuticals, drugs, paint, paper, light alloys, textiles, dyestuffs, precious metals, plastics, soap, rubber, foodstuffs, beverages and numerous other products.

The Doulton range of laboratory and technical porcelain includes a wide range of evaporating basins, crucibles, beakers, funnels, mortars and pestles and such special items as mercury troughs, staining troughs, cover rings, filter discs, depression tiles, combustion boats, bunsen burners, and anaerobic boxes, and a selection of miniature apparatus for use in micro-analysis.—**BIF, Stand D.743/642, Birmingham.**

STANDARDISING THE *p*H SCALE

U.S. Proposal for Consistent Values

THE *p*H unit to express numerically the degree of acidity or alkalinity of aqueous solution, may be defined in a number of ways, each resulting in a slightly different value for the *p*H of a given solution. Consequently, several *p*H scales, based upon various definitions, have met with equal favour among chemists.

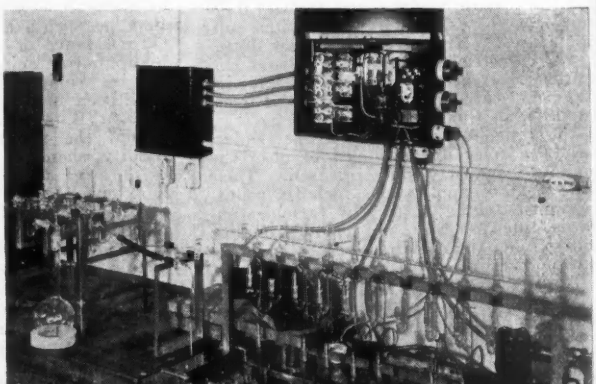
In view of the increasing need in science and industry for accurate determinations of acidity, the U.S. National Bureau of Standards is recommending the universal adoption of a single standard *p*H scale, analogous to the International Temperature Scale. It is proposed that the measure should be the *p*H assigned to solutions of buffer substances distributed by the Bureau of Standards and that the samples be taken as the fixed points in this standard scale.

In the preparation of many commercial products—for example, paper, textiles, dyes, ceramics, and beer—the rapidity and efficiency of the processes depend upon accurate control of the acidity or alkalinity of aqueous solutions. Such control is now a regular requirement in the preparation of certain medicines and in the manufacture of paper and leather.

In sugar manufacture, the inversion of sucrose can be regulated at will or avoided entirely by holding the acidity within certain limits. Similarly, regulation of the acidity of electroplating solutions permits the character of the deposit to be controlled. Another application of particular importance is the avoidance of corrosion and embrittlement of boiler walls and tubes by regulation of the acidity of boiler water. The widespread losses due to underground corrosion are likewise effectively curbed in many cases by proper adjustment of acidity.

The several convenient *p*H meters now available commercially enable precise determinations of *p*H values in such varied media to be made with ease and rapidity, but these values are based upon a scale fixed by the *p*H assigned to the standards with which the instrument has been calibrated. The differences among scales of *p*H are the direct result of different procedures, definitions, and assumptions employed in arriving at the *p*H of the standard.

The *p*H may be defined in one instance as the negative logarithm of the hydrogen-ion concentration; or, again, of the effective concentration or "activity" of



The source of the U.S. National Bureau of Standards' electromotive force data associated with pH values. The standard solutions are contained in the special cells, with hydrogen and silver-silver chloride electrodes, in a constant - temperature bath. A potentiometer measures electromotive force

this ion. Sometimes the *p*H value defined by Sorensen in terms of the electromotive force of a galvanic cell with hydrogen and calomel electrodes chosen.

Although the differences among these scales rarely exceed 0.1 unit, the need for greater accuracy makes desirable the general adoption of a single series of consistent *p*H standards.

In its present attempt to procure uniformity in *p*H measurements, the U.S. National Bureau of Standards is now supplying four buffer substances in the form of standard samples of certified purity. These substances are acid potassium phthalate, potassium dihydrogen phosphate and di-sodium hydrogen phosphate (intended to be used together), and borax. They are being distributed at the rate of several hundred samples annually. The certificates furnished with these compounds specify the *p*H of certain aqueous solutions of the sample, which can provide fixed points on a *p*H scale.

In order to assign exact values to these fixed points, it was necessary to set up a scale based upon some suitable definition of *p*H. A consideration of the advantages and limitations of several scales led to a choice of a modified activity scale as most convenient and practical for general use. Although the activity of a single ionic species can be simply defined only in very dilute solutions, the influence of the hydrogen-ion activity in chemical equilibria is of far-reaching importance.

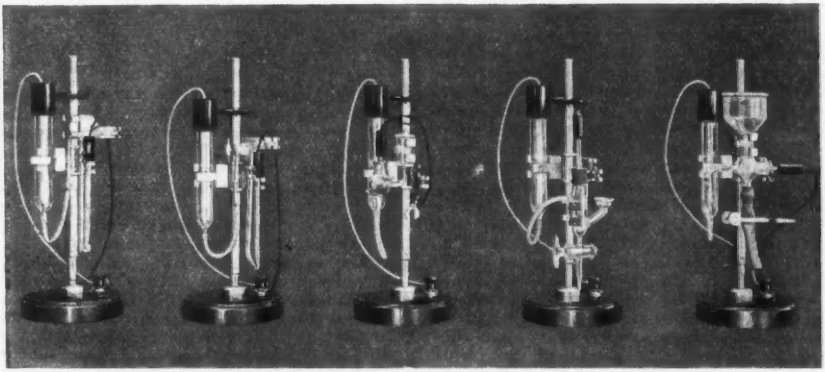
The *p*H of the U.S. National Bureau of Standards standard is derived from measurement of the electromotive force of cells without liquid junction, in which they are used as electrolytes. These cells are specially designed, utilising the highly reproducible hydrogen and silver-silver chloride electrodes.

Computation of *p*H is based upon several reasonable assumed relationship between ionic activities and mean activities. These assumptions are found to give identical values for dilute solutions. The scale thus obtained approaches a true scale of activity for solutions of low concentration; at higher ionic strengths it is best regarded as a consistent scale which necessarily rests upon an assumption not subject to experimental proof.

New Designs for pH Measurement

THE electrodes designed for use with the range of *p*H meters by MUIRHEAD & CO., LTD., are stated to possess many original features. In particular, the construction of the stand and mounting tube is based on sound principles of geometric design. It combines lightness with rigidity, and is capable of carrying any of the regulation electrode assemblies. Only 18 separate items make up the entire range, and from these the electrode assemblies can be constructed. Several items are common to two or more assemblies, so that the cost of widening the field of application of Muirhead *p*H meters is not great.

The electrodes supplied with types D-303-C, D-417-A and D-449-A comprise a dip-type glass electrode containing a silver/silver-chloride half-cell and a calomel half-cell carried in a reservoir of



Five representatives of Muirhead electrode assemblies

potassium chloride solution. The reservoir is connected to the solution under test through a tube of plastic material containing a partial obstruction and a glass tube terminating in a capillary, which is held close to the glass electrode by a stand. Assemblies are supported on the stand by means of clips attached to the mounting tube; in certain cases, additional clips are provided. The component parts are available separately to meet the requirements of customers who are already in possession of some of them and do not wish to duplicate their equipment.

Other new instruments and laboratory equipment by Muirhead & Co., Ltd., include a universal unit conductivity bridge, and a miniature Weston standard cell. An important advantage of the type of construction used in the latter is stated to be that virtually no temperature difference is possible between the mercury and cadmium amalgam half-cells. As the temperature coefficients of these are both relatively large, and opposite in sign, the risk of large changes in e.m.f. due to uneven temperature variation is largely eliminated.

COMPACT instruments for the determination of *p*H have been available for several years, and the potentiometric type made by the CAMBRIDGE INSTRUMENT CO., LTD., are prominent among these. The new Cambridge direct reading *p*H indicator has been designed to meet the demand for a method of *p*H measurement comparable in simplicity and ease of reading with the instruments for long available, for example, for the measurement of temperature. This instrument is exceptionally simple in operation, and is claimed to be so stable that in ordinary circumstances the indicator need only be standardised against a buffer solution once a day. It may then be left in the hands of less experienced technicians for routine readings, thus rendering it an ideal instrument for works or laboratory use in the large number of applications where very high accuracy of reading is not required.

The instrument incorporates an open-scale pointer galvanometer of great reliability. The *p*H is read directly on the 120 mm. scale, covering the whole *p*H range of 0 to 14. with sub-divisions to 0.1 *p*H. Readings can be easily taken to 0.05 *p*H or less. Temperature compensation for the electrode system is provided by rotating a dial at the front of the instrument, the range covered being from 10° to 100°C. while the method of standardising the instrument against the buffer solution is also very simple.

The Cambridge direct-reading pH indicator

Metal Workers' Equipment

A NEW bench type micro-hardness tester, developed by the Guest, Keen & Nettlefold laboratories, has been produced by HALL TELEPHONE ACCESSORIES, LTD. This instrument is supplied with a bench type metallurgical microscope having a screw micrometer eyepiece and is suitable for performing identation or scratch tests using a 136° angle diamond pyramid indenter. It consists of a turret head with positive indexing, carrying a pivoted beam and two centralising objective adaptors. The beam pivot consists of two light leaf springs set at right angles to each other. This arrangement is claimed to make the beam stiff to horizontal and vertical deflections but relatively free to rotate, and provides a frictionless bearing.

CLAIMED to be an important addition to the present range of light welding equipment, a new transformer, type 1368, has been developed by Philips Electrical, Ltd. It is compact, portable and is suitable for use in all types of maintenance welding and on production lines in sheet and heavy metal-working shops.

The welding current control is continuous over the range of 70-350 amps, and the two current ranges available are: (low range) 70-170 amps (high range 170-350 amps. The transformer can be connected to any of six mains voltages between 190 and 500 volts. The connection value at the maximum load of 350 amps is 24.5 kVA.

Uniform Heating of Liquids to 350° C.

Comparative Data of Small-Scale Systems

By H. REIK, M.Sc.(Eng.), A.M.I.E.E., A.M.I.Mech.E.

NEARLY all chemical processes require the application of heat at one stage. This article is mainly concerned with the efficiencies and some other factors of methods adapted for use in small and medium scale production.

New heating methods have been developed during the last few years and it is likely that the plant and development chemist will be able to use the following notes as a general guide to the type of heating he can apply to his own plant when concerned with the application of temperatures between 100° and 400° C. (212° and 750° F.). Three methods mainly are used: direct firing: jacketing (indirect surface heating) and direct surface heating.

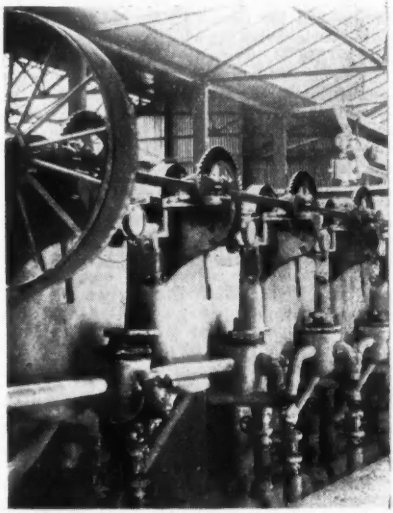
Direct Firing

1. Gas burners are the heaters most commonly used for direct firing. The method has a low primary cost. The air used is often preheated by simple heat exchange, but is low. Temperatures up to 350° C. can be reached, but the risk of excessive temperatures is always present if the level of the liquid drops. Direct contact with the flame may induce local overheating and distortion of containers. The temperature gradient between flame or gases and liquid is always high.

2. It is standard practice to jacket vessels like pressure autoclaves, reaction kettles and the like, thus allowing a heating medium to be applied to a large surface. The medium used can be either in the liquid or vapour phase, either type giving nearly uniform surface temperatures. The liquid temperature (save in the case of exothermic processes) is limited to that of the heating medium and local overheating is nearly always avoided, because of the comparatively small temperature gradient between medium and liquid at normal rates of heat transfer.

3. *Liquid Phase*: A fairly common form of heating medium in the liquid phase is circulating hot oil. A mineral oil, which must be free from unsaturated hydrocarbons and low volatile constituents, is used. It must have a high flashpoint and should not carbonise at high temperatures.

Oil itself is a poor conductor of heat and care must be taken that no overheating and carbonisation occurs in heating.



[By courtesy of General Engineering Co. (Radcliffe), Ltd.

Fig. 1. Jacketed bituminous mixers with jacketed pipes and cocks, all heated by oil circulation

This can be secured by maintaining a high rate of flow over the oil heaters by the use of circulating pumps designed to withstand the high temperatures involved. The oil heaters or absorbers consist either of circular tubes for smaller units (up to 200,000 BThU per hour) or straight tube to 5 million BThU per hour. The heat source for the smaller is gas or oil, and coal, coke or fuel oil for the larger units.

The maximum temperature range of this type is 288° C. (550° F.). The overall heat transfer for forced oil circulation of this type from heating medium to liquid is between 25 and 50 BThU hr./sq. ft./°F.) It is therefore advisable not to exceed 260° C. (500° F.) in the vessel if reasonably fast distillation rates are desired.

Electric immersion heaters are often fitted inside an oil jacket for smaller installations. As such heaters often rely on convection currents, passages must be

kept clear; slow circulation might cause local overheating of the immersion heaters and cracking and carbonisation of the oil.

Heating and cooling of the oil will be comparatively slow as fairly large volumes are usually employed.

Organic Silicates

Organic silicates have recently been introduced for liquid phase heating. They will work satisfactorily at temperatures up to 316°C. without deterioration.

A typical silicic acid ester used is tetra aryl silicate (TAS). This is a mixture of several phenyl-cresyl orthosilicates which will have a long working life at temperatures up to 316° C. (600° F.). Its properties are shown in Tables I and II.

TABLE I.—TETRA ARYL SILICATE

Composition : Organic silicate.
Solubility and compatibility with other liquids (at room temperature) : Water—insoluble, hydrolises slowly. Alcohols—soluble, slow alcholysis. Hydrocarbons—partly soluble in aliphatics. Chlorinates solvents—soluble.
Dielectric strength : Fair resistance.
Acidity : None.
Colour : Amber.
Odour : Slight phenol.
Hazards : None ; non-corrosive, non-toxic, non-explosive and offers little fire hazard.
Handling precautions : Protect against moisture, open flame and prolonged skin contact.

The tables show that TAS can be used as a heating and cooling liquid. Its control and heating is very similar to that of hot oil circulation.

Fig. 2 shows flow and return pipe connections in a recently installed plant

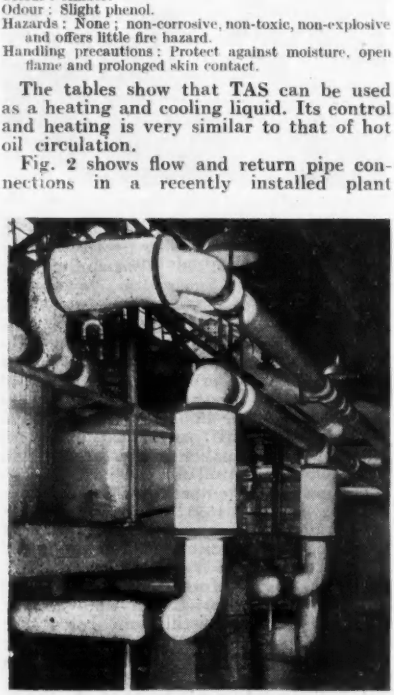


Fig. 2

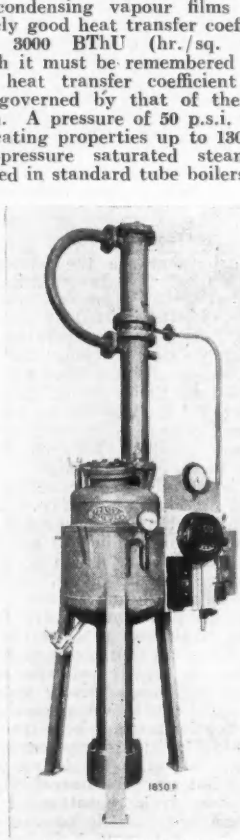
(developed by Mactaggart and Evans at Leda Chemicals, Ltd., in conjunction with Hygrotherm Engineering, Ltd.).

Higher temperature liquids are in the development stage and it is probable that temperatures of up to 375° C. (700° F.) will be reached in the not too distant future.

Vapour Phase Saturated Steam

Large works often have available appreciable quantities of by-pass steam at about 50 p.s.i. Such saturated steam will condense on the heating surfaces of the jacketed vessels giving up its latent heat. These condensing vapour films give an extremely good heat transfer coefficient of up to 3000 BThU (hr./sq. ft./°F.), although it must be remembered that the overall heat transfer coefficient is only partly governed by that of the heating medium. A pressure of 50 p.s.i. will give good heating properties up to 130/140° C.

High-pressure saturated steam, often generated in standard tube boilers or elec-



[By courtesy of W. J. Fraser & Co., Ltd.

Fig. 3. Small vessel jacketed for Dowtherm heating and supplied with its own control panel

ode boilers, is used at temperatures up to 200° C., but it has the disadvantages associated with runs of high-pressure pipes, valves and joints.

Steam pressures above 400 p.s.i. will produce temperatures little higher than 230° C. These very high pressures are avoided by the use of an eutectic mixture of a diphenyl—diphenyl dioxide having a boiling point of about 258° C.

It can be seen that liquids can be heated to temperatures of about 350° C. at comparatively low vapour pressures. The great advantage of Dowtherm is its stability at these high temperatures. The working range is from 230° C. to 380° C. (vapour temperature). It is advisable not to exceed 380° C. and to avoid local overheating, as decomposition can then take place.

Ease of Control

Dowtherm A is not toxic in concentrations which could arise due to leaks. Because of its high wetting power it can, however, penetrate leaks which would ordinarily not be detected, making its presence apparent by a very unpleasant odour. Its own heat transfer coefficient is between 200 and 300 BThU (hr./sq. ft./°F.) when condensing. Being a saturated vapour, its temperature is determined by its pressure and can easily be controlled by a throttle valve within plus and minus $1\frac{1}{4}$° C.

Natural circulation boilers are used for pressures up to 60 p.s.i., while forced circulation should be employed for higher pressures. Water tube boilers up to 50 million BThU per hour capacity have been built in America.

Electric immersion heaters have been used for units up to 750,000 BThU per hour. A recent installation is at British Nylon Spinners, where both vessels and pipes are jacketed for Dowtherm vapours.

Superheated Steam

Superheated steam is often generated for high temperature heating because it allows lower pressures to be used. The advantage of condensing is lost, however, and heat transfers are of the order of only 2-5 BThU (hr./s. ft./°F.). This will therefore be useful to keep liquids at high temperatures or for slow rates of heat transfer. The method is not very efficient because of the comparatively high pipe losses, particularly if the steam has to be specially generated.

This is really a compromise between direct firing and jacketing. The heating surface is applied directly to the outer surface of the unjacketed vessel. It can be designed to have a uniform temperature or be given any desired heat gradient, often with the purpose of increasing convection currents in the liquid.

The method was developed in this country by the author in conjunction with Isopad, Ltd., for problems concerning glass plant where jacketing was not practicable.

The heater consists of electrical resistance wires which are interwoven with or attached to glass yarn cloth of the staple fibre type. The heating panel is shaped to surround the surface of the vessel to be heated. A lagging jacket is either in-

(*Text continued on page 643*)

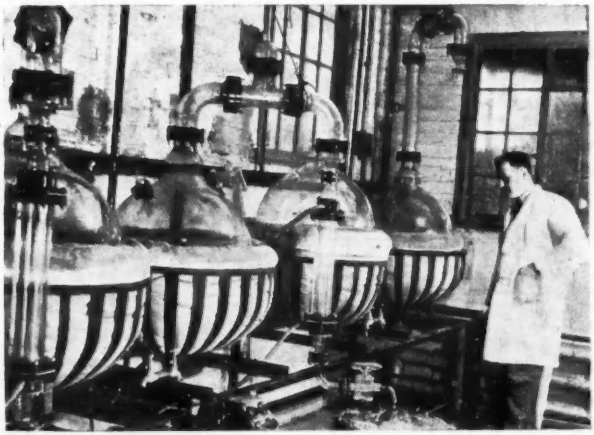


Fig. 4. Pilot plant heating in glass: a battery of 100-litre stills using Isomantles as the heat source

By courtesy of F. W. Berk & Co. Ltd., and Isopad Ltd.

TABLE II.—TETRA ARYL SILICATE: TABULATED PROPERTY DATA

Temperature °F.	Temperature °C. approx.	Viscosity Centipoises	Redwood Seconds*	Specific Gravity	Cubical Expansion per °F. ×10⁴	Cubical Expansion per °C. ×10⁴	Specific Heat	Vapour Pressure m.m. Hg
0	−18	740	260 (2)	1.182	3.98	7.16	0.36	—
50	10	52	190 (1)	1.158	4.07	7.33	0.37	—
100	38	14.2	60 (1)	1.135	4.15	7.47	0.39	—
150	66	6.4	circa 40 (1)	1.112	4.24	7.63	0.40	—
200	93	3.6		1.089	4.32	7.78	0.42	—
250	121	2.3		1.065	4.42	7.96	0.45	—
300	149	1.55		1.041	4.52	8.14	0.48	—
350	177	1.16		1.018	4.63	8.33	0.51	—
400	204	0.92		0.994	4.74	8.53	0.55	—
450	232	0.74		0.970	4.85	8.73	0.59	1.1
500	260	0.61	Less than 40 (1)	0.946	4.97	8.95	0.64	4.15
550	288	0.50		0.923	5.10	9.18	0.69	13.4
600	316	0.43		0.900	5.23	9.41	0.74	37.5
650	344	0.37		0.875	5.38	9.68	0.80	91.0
700	372	0.32		0.853	5.53	9.95	0.86	200.0
750	399	0.29		0.830	5.68	10.22	0.92	405.0
800	427	0.25		0.807	5.84	10.51	0.98	760.0

* Suffix (1) indicates Redwood No. 1. * Suffix (2) indicates Redwood No. 2.

TABLE III.—PROPERTIES OF SATURATED DOWTHERM VAPOURS

Temperature °F.	Temperature °C.	73.5% Diphenyl Oxide Pressure lb./sq. in. abs.	73.5% Diphenyl Oxide Pressure Vacuum in Hg.	26.5% Diphenyl Heat Content B.Th.U./lb. Liquid	26.5% Diphenyl Heat Content B.Th.U./lb. Latent	26.5% Diphenyl Heat Content B.Th.U./lb. Total	Specific Heat Liquid	Density lb./cu. ft. Liquid	Density lb./cu. ft. Vapour
53.6	12.0	—	—	0	164	164	0.37	—	—
60.0	15.6	—	—	2.4	163	165	0.38	—	—
70.0	21.1	—	—	6.2	162	168	0.38	—	—
80.0	26.7	—	—	10.1	161	171	0.39	—	—
90.0	32.2	—	—	14.0	160	174	0.39	—	—
100.0	37.8	—	—	18.0	158	176	0.40	—	—
120.0	48.9	—	—	26.0	157	183	0.40	—	—
140.0	60.0	—	—	34.2	155	189	0.41	—	—
160.0	71.1	—	—	42.6	154	197	0.42	—	—
180.0	82.2	—	—	51.2	152	203	0.43	63.1	—
200.0	93.3	—	—	60.0	150	210	0.44	62.5	0.0012
220.0	104.5	—	—	69.0	148	217	0.45	61.9	0.0020
240.0	115.0	0.18	29.63	78.2	146	224	0.46	61.4	0.0034
260.0	127.0	0.30	29.39	87.7	144	232	0.48	60.8	0.0056
280.0	137.0	0.48	29.023	97.5	143	240	0.49	60.1	0.0080
300.0	149.0	0.74	28.45	108.0	142	250	0.50	59.6	0.012
320.0	160.0	1.14	27.68	118.0	140	258	0.52	58.9	0.019
340.0	171.0	1.62	26.70	128.0	138	266	0.53	58.4	0.026
360.0	182.0	2.30	25.32	138.0	137	275	0.54	57.8	0.036
380.0	193.0	3.10	23.69	150.0	136	286	0.55	57.3	0.050
400.0	204.0	4.10	21.66	162.0	134	296	0.57	56.7	0.068
420.0	216.0	5.40	19.01	174.0	132	306	0.58	56.2	0.090
440.0	227.0	7.20	16.29	186.0	130	316	0.59	55.7	0.12
460.0	238.0	9.20	12.77	198.0	128	326	0.60	55.2	0.16
480.0	249.0	12.0	5.58	210.0	125	334	0.62	54.6	0.21
			p.s.i. gauge						
500.0	258.0	14.7	.0	222.0	123	345	0.63	54.1	0.28
520.0	271.0	20.4	5.7	234.0	120	354	0.64	53.2	0.36
540.0	282.0	25.1	10.4	247.0	118	365	0.65	52.7	0.44
560.0	293.0	30.8	16.1	260.0	115	375	0.65	51.9	0.54
580.0	304.0	36.6	21.9	274.0	112	386	0.66	51.2	0.67
600.0	315.0	44.3	29.6	288.0	110	398	0.66	50.4	0.88
620.0	327.0	53.0	35.4	302.0	107	409	0.67	49.8	1.10
640.0	338.0	63.6	48.9	316.0	105	421	0.67	49.1	1.24
660.0	349.0	74.2	59.5	330.0	102	432	0.68	48.4	1.34
680.0	360.0	87.7	73.0	344.0	99	443	0.68	47.5	1.5
700.0	371.0	104.0	89.3	358.0	97	455	0.68	46.9	1.7
720.0	382.0	119.0	104.0	372.0	93	465	0.68	45.9	1.9
740.0	393.0	142.0	127.0	386.0	90	476	0.68	44.9	2.3

TABLE IV.—JACKETED VESSELS

Fluid Inside Jacket	Fluid in Vessel	Wall Material	Agitation	U
Overall Coefficients U expressed in B.Th.U./hr. sq. ft./°F.				
Steam	Water	Enamelled C.I.	0–400 r.p.m.	96–120
Steam	Boiling SO_2	Steel		60
Steam	Water	Copper	None	148
Steam	Water	Copper	Stirring	244
Steam	Boiling water	Copper	None	250
Steam	Paraffin wax	Copper	None	27

(Table IV from A. P. Colburn, 1932-40, and McAdam-Heat Transmission.)

corporated into the heater or separately applied.

This lagging jacket also consists of glass cloth, having 2-3 in. thickness of glass wool lagging. The weight of small containers or pans is borne by the heaters, which in turn are supported by special stands. Containers over 60 gal. capacity have separate supports.

The lagging used permits efficiencies of the order of 90-95 per cent. It is usual to subdivide the heating area into horizontal segments, each of which consists of a separate circuit, which can be independently controlled.

The variable control enables the input into the upper circuits to be reduced if the level of the liquid drops.

The energy input is controlled either by on-off energy regulators, tapped transformers with tapping switches in the secondary, or simple on-off switches where fine control is not required and several circuits are available. The heaters are designed not to overheat under normal conditions.

Temperature control (which is not the same as energy control) is usually provided for higher powers at temperatures above 250° C. in order to reduce the influence of the human element. Such control can be either of the thermocouple-amplifier-power relay type or of the expanding liquid-power relay type. In either case, temperature can be controlled to very fine limits. Dual control can be employed with thermocouples both in the liquid to be heated and on the element.

The combination of energy and temperature control will allow processes to be run up to working temperature at a controlled BThU input, while temperature control limits the maximum temperature of the liquid.

While the element itself can be run up to 430° C. (805° F.), its use is limited to processes under 375° C., because a reasonable heat gradient is required between heater and liquid.

Heat Transfer

Actual heat transfer from the heating medium to the liquid is governed by the following main factors:—

(1) Heating medium and its phase;
(2) Type of liquid to be heated;
(3) State and temperature of liquid (whether agitated, etc.);
(4) Container material and surface condition.

Fig. 5 shows typical heat transfer curves for an enamelled cast-iron vessel which is assumed to be jacketed for the liquid and vapour phase processes, but without jacket for the application of direct surface heating.

The liquid is assumed to be an organic oil slightly agitated, while a heat transfer from the heating medium to the liquid of 1000 BThU/sq. ft./hr. is required.

It can be seen that both circulating hot oil (a) and TAS (b) show a considerable temperature drop between the heating medium and the outer surface of the vessel; there is hardly any drop across the cast iron, a small drop across the enamel and again a heavy drop across the stationary film separating the inner surface of the vessel from the slightly agitated liquid to be heated. This drop is governed by the amount of agitation provided, the viscosity of the liquid and its thermal conductivity.

Condensing vapours (225 p.s.i. steam (c); 50 p.s.i. Dowtherm (d); and 115 p.s.i. Dowtherm (e)) show their advantage, based on the fact that there is hardly any temperature drop between heating medium and inner surface, due to the latent heat of the liquid condensing on the surface of the vessel. The drop across the vessel and the film of the liquid to be heated is, of course, the same as before.

Superheated steam (f) gives a poor heat transfer, even under optimum conditions; while (g) shows that there will be two drops between an electric surface heater and the outer surface of the vessel; 1 between element and glass cloth; 2 between the glass cloth and outer surface.

Tables IV and V show some experimental results in tabulated form both for jacketed vessels and heat exchangers.

Comparison in Pilot Plants

The data presented here show that condensing vapours will give the best

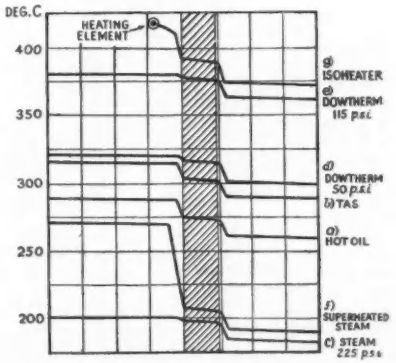


Fig. 5

possible rates of heat transfer. There is a gap between 180° C., where steam can still be used, and 250° C., where Dowtherm can be applied. This gap is conveniently filled by hot oil circulation heating and TAS heating. These have also merits of their own where users wish to avoid vapours under pressure.

The electric surface heater covers all temperature levels and has the advantage of simplicity in installation and comparatively low primary cost. It is, however, limited to maximum rates of heat transfer in the region of 2000 BThU/sq. ft. up to 200° C. and to 1200 BThU/sq. ft. above 300° C., unless automatic temperature control is employed.

Superheated steam will hardly ever be used for pilot plants. There is a tendency to use electric surface heaters of the Isomantle and Isojacket type for nearly all glass plant, although steam type boiler heat exchangers are preferred for temperatures below 120° C. where high rates of heat transfer are required.

It is rather difficult to compare running expenses per BThU transmitted, because of the many factors that have to be considered. Some of these are comparative rates per therm and kW-hour, cost of fuel, duty cycle involved, size of plant, etc.

Operating a small or medium-size plant requiring a working temperature of 200° C., high-pressure steam would give the best absolute efficiency, using an efficient boiler placed near to the jacketed vessels. This effect would be closely followed both by hot oil circulation and TAS, boiler heated.

Electric heating, whether as direct surface heating or as immersion heaters for liquid heating, would have a high efficiency —up to 95 per cent. Against this, however, is set the comparatively high cost of the electrical unit due. Gas heating with efficiencies between 35 and 45 per cent is very similar in final running cost, but the relationship is determined by the local tariffs.

If the temperature of the plant required to be in the region of 300° C., Dowtherm would be most economical, if boiler heated; and the next in order of efficiency would be TAS (boiler heated).

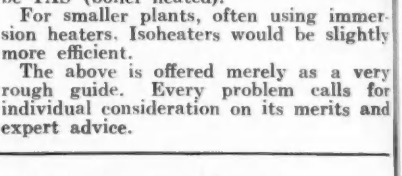
For smaller plants, often using immersion heaters. Isoheaters would be slightly more efficient.

The above is offered merely as a very rough guide. Every problem calls for individual consideration on its merits and expert advice.

Safety Control of Non-Luminous Flames

THE protection of gas-fired installations against chances of explosions due to carelessness when lighting up, or to flame failure is now recognised to be of widespread importance. Certain types of flame, however, are not sufficiently luminous to affect the ordinary photoelectric cell used in modern flame control devices. That would be the case when burning methane, water gas, producer gas, etc., or when using non-luminous types of burners with ordinary coal gas. For such applications a London firm of photo-electric and electronic control engineers (Radiovisor Parent, Ltd.) has introduced a special equipment. This is the Type FR. 49 Flamestat, which operates on principles entirely different from those employed in other models, although retaining the feature of instantaneous operation.

The equipment utilises the effect that flame serves as a partial conductor of electricity by instantly ionising the air in the immediate vicinity, thus making the air a conductor of electricity. A rod-type flame detector, electrically connected to the control unit, projects into the pilot flame, completing a circuit *via* the flame, to earth and closing a relay in the control



unit which energises electrically-operated gas valves, holding them open. Immediately the flame fails, the circuit is broken and the valves close, shutting down the gas supply to the pilot light flame and burner. The unit may be connected to any type of electro-magnetic or motorised control valve. Being completely independent of thermal effects, the equipment is instantaneous in operation, and does not suffer from fatigue. It is unaffected by heat and is stated to be extremely sensitive and positive in action.

The control unit employs a single-stage thermionic valve amplifier within a small pressed steel housing (9 in. by 6 in. by

(*continued at foot of facing page*)

CHEMISTS' AND AIRCRAFT DEVELOPMENT

Exacting Requirements of Plastic Components

THE contribution of the chemist to aircraft development was the subject of a comprehensive review presented recently before the British Association of Chemists by Dr. T. B. Hughes (the Ministry of Supply).

The main function of the chemist in aircraft development, said Dr. Hughes, has been the continuous synthesis of new compounds and materials with improved properties. For structural purposes, the choice of materials is limited to those with (a) a high strength/weight ratio, (b) constancy of physical and chemical properties over a wide temperature range, and (c) resistance to weathering in climatic extremes.

Fuels and Plastics

The speaker limited the main part of his talk to two important contributions of chemists to aircraft development, viz., the production of high octane fuels for piston engines during the 1939-45 war, and the more recent studies on crazing of polymethyl methacrylate made at the Royal Aircraft Establishment and elsewhere.

The importance of octane number in determining the power output and fuel economy of supercharged aircraft engines was briefly outlined, and the contribution of fuel constituents in increasing the octane number explained. A survey was made of the rapid expansion of chemical cracking, polymerising, and alkylating plants for making iso-paraffins, especially isooctane, and it was emphasised that this achievement was made possible only by the continuous chemical research in the laboratories of oil companies in the pre-war years.

It was emphasised that the difficulties with the present material for aircraft windows and canopies, the polymer polymethyl methacrylate, were largely due to the higher speeds and pressurisation of modern civil and military aircraft. The material is subjected to higher stresses and its failure is now a serious hazard.

Solvent absorption and related studies with the polymer at the Royal Aircraft Establishment had shown that the surface failure or "crazing" was caused by the combined action of stress and solvents. The stresses could be "built-in" by the forming process and the solvent could be present initially as the monomer; such materials crazed readily.

Heat treatment processes for relaxing integral stresses and for completing polymerisation were summarised, and the importance of the Second Order Transition Temperature explained in relation to absorption processes and stress relaxation.

In service, the material is subject to a variety of stresses, which the designers are attempting to reduce to a minimum, while solvents may be picked up from gasoline vapours, cleaning materials etc. It is important that transparent components should be most carefully designed and maintained, and that the polymer should absorb the minimum of organic liquids or vapours brought into contact with it.

CONTROL OF NON-LUMINOUS FLAMES

4 in.). Green and red warning lights are incorporated to indicate normal running conditions or flame failure, and terminals are provided for connecting an external alarm bell. Mounted in the control unit is a robust relay connected externally to electro-magnetic or solenoid gas valves which are held open only when energised.

The flame detector carries the electrode rod, which is electrically connected to the control unit and projects into the pilot flame. The rod, mounted in a robust aluminium casting, is held in a threaded barrel which is welded or bolted to the boiler cover plate. The standard electrode rods are suitable for flame temperatures up to 850°C. and project 20 in. from the housing. Rods of any length and special types to withstand temperatures up to 2000°C. are, however, available.

The control equipment may be incorporated in circuit with thermostats, low water cut-outs, air flow swiches and similar control equipment, and there is a wide variety of ways in which the control unit may be connected to the gas valves. There is, for example, a manual ignition system in which the pilot gas is caused to flow by depressing a push-button starter. The pilot light is then ignited, completing a circuit to keep the starter button depressed. Release of pressure on the button automatically causes the main gas supply to flow, the circuit being so arranged that this cannot take place unless the pilot is alight. Should the flame fail, both gas valves immediately close.

SOUTH AFRICA'S CHROME RESERVES

Three Years' Steady Increase of Output

FIGURES for 1949 issued by the Union Department of Mines indicate that South African sales of chrome ore again reached a high total of 360,432 tons, valued at £1,015,741, compared with 347,379 tons, valued at £864,807, in 1948. In 1947 a total of 339,086 tons was sold.

The steady increase in the tonnage of chrome ore produced and sold indicates the extent of the demand for chrome that exists throughout the world, states *The South African Mining and Engineering Journal*, from which the following abstracts are taken.

The bulk of South Africa's chrome goes to the U.S.A. The 1949 details of exports have not yet been issued by the Department of Mines, but in 1948 the U.S.A. took 276,523 tons, the remainder of the sales tonnage being split between 13 other countries.

The ore exported is mainly friable and is best adapted for chemical use. In 1947, the last year for which complete figures are available, the Union supplied 83 per cent of the U.S.A.'s imports of chemical grade chrome ore.

The need for dollars has dictated more than ordinary attention to shipments of chrome ore. In point of fact, however, South Africa's production in each of the past three years has only just topped the output for the wartime peak attained in 1942.

Largest Deposit

In the Bushveld Igneous Complex of the Transvaal South Africa possesses what is probably the largest known reserve of chromite in a single geological formation. No other of comparable size is known.

According to estimates made by the Union Department of Mines, a conservative calculation of the available reserves of ores in South Africa is 200 million tons.

Transvaal ore is used mainly in the chemical industry and in the manufacture of chromic refractories. For the former the friable ore is generally preferred, the hard, lump ore going chiefly for refractory purposes. A considerable outlet for this ore lies in cements for patching and protecting furnaces, and also in making chromite bricks. Selected concentrated Transvaal ores are used to some extent in the manufacture of ferro-chrome both in the Union and overseas.

One of the difficulties experienced with many Transvaal chrome ores has been to find a technique which would produce a grade of concentrate sufficiently rich in chromic oxide to find a wide market. Experiments were carried out some years ago in the field by the operating companies, and the stage has now been reached where a satisfactory concentrate is being produced. In the interim, however, the companies concerned spent considerable sums trying to achieve a product which would meet the current demand.

While South Africa produces mostly chemical grade chrome ore, Southern Rhodesia is regarded as one of the world's most important sources of metallurgical grade ore. The ore has a high chrome oxide content and the estimated reserves are large.

The known grades of ore throughout the world are mainly of the refractory and chemical types, whereas the present world consumption is largely of the high chrome content type metallurgical ore. This suggests that the time may come when it will be necessary to use more of the ores with a high iron content, wherever they can be substituted for high chrome-bearing ores.

Chemical grade ores should be as high in Cr_2O_3 and as low in SiO_2 and Al_2O_3 as possible. Specifications are rather more variable and less rigid than in the case of metallurgical and refractory grades and are generally determined on a basis which takes into account availability and price. It follows that the price obtained for chemical grade ores is quite considerably lower than for the other grades.

Electro-Chemical Research in India

THE Indian section of the International Electro-Chemical Society, (founded in 1902 for the promotion of the study of electro-chemistry) has been inaugurated at Bangalore by Dr. B. K. Ram Prasad, of the Electricity Grid Department, Government of Bombay. Dr. Prasad said that the Government of India had proposed to form an Electro-Chemical Research Institute and hoped that the National Planning Committee set up by the Government of India would take note of the possibilities of development of these industries. It was suggested that the scrap copper available in Mysore could supply a flourishing industry.

PRODUCTION OF W. GERMAN CHEMICALS

Cautious Buying and Increased Import Competition

THE anticipated increase in output of the German chemical industry in the British zone in January did not take place and statistics indicate that the production level was about that of the previous quarter.

That information comes from the *Monthly Report of the Control Commission for Germany (British Element)* (5, No. 2, 48), which adds that production was limited more by market difficulties than by any shortage of capacity, raw materials or power.

The main difficulties were the generally limited purchasing power of users, the cautious purchasing policy adopted even where money was available, as, for example, the failure of farmers to take up normal supplies of fertilisers, and competition from imported materials, as in the paints and varnishes, soap and pharmaceutical industries.

Fertiliser Materials

The production of finished nitrogen fertilisers increased from approximately 34,700 tons in December to 40,200 tons in January. The production of synthetic ammonia, however, decreased by about 1000 tons. Storage difficulties showed no signs of diminishing.

An increase by over 2300 tons in the output of phosphate fertilisers was recorded, making 27,400 tons, in terms of phosphorus pentoxide (P_2O_5). The increases were in Rhenania phosphate and basic slag.

The production of superphosphate remained low; one factory closed down during the month owing to lack of storage space and some others worked at only 50 per cent capacity for the same reason. The position was affected by the cessation of deliveries to the Soviet Zone at the end of 1949, imports of superphosphates from processing contracts and the continuation of a poor internal sales position. Deliveries to the Eastern Zone were renewed on a reduced scale.

A rise of nearly 5000 tons during January to 73,000 tons of potassium oxide (K_2O) is reported. Burbach Kali Werke, which is reopening one of its mines near Göttingen, has made considerable progress and workings are now about 300 m. nearer the potash deposits than at the beginning of the year. This long term scheme, when completed, is expected to double the firm's present production.

Sulphuric acid production increased by 4000 tons to approximately 87,000 tons of sulphuric anhydride. A contract for the import of sulphuric acid from Belgium for nitrogen fixation was completed and another contract is being negotiated.

Owing to low demand, production of soda ash in the Federal Republic fell by over 5000 tons to 49,500 tons. Production of caustic soda remained about the same, but a large proportion was put into stock. The output of calcium carbide fell by about 3000 tons to 46,000 tons, partly due to repairs at Knapsack, and that of dyestuffs rose slightly to about 2000 tons.

The prospects for improvement in the production of synthetic resins and plastics were jeopardised by imports from neighbouring countries, under the recent liberalised trade policy. Manufacturers gave attention to export possibilities to compensate for loss of home trade.

Ample supplies of methanol were available. Large stocks accumulated in Land Niedersachen and, the Land Government ended distribution control. The demand for high class solvents and plasticisers continued to be good and there was considerable price competition internally and in world markets.

Coal tar distillation products, such as pitch, naphthalene, anthracene and pyridine, were fully utilised by the home market, but there was some excess of tar oils. There was severe competition in export markets and price-cutting resulted.

Three-fold Increase in Chemical Exports

CHEMICAL and allied exports from Western Germany during recent months have continued at the fairly high rate reached towards the end of last year. A falling-off in shipments of semi-finished products has been offset by larger consignments of paints and pharmaceuticals. exports of most groups of chemicals are now three times as large as in early 1949.

The first pre-war shipment of German rayon to the U.S.A. has arrived in New York and is reported to have been sold

at a price 2 cents per lb. less than the U.S. domestic price.

Among recent trade agreements likely to result in an expansion of chemical exports from Western Germany is one with Spain, under which Germany is to receive chemicals, including pyrites, valued at $5.2 million during the 12 months beginning May 1 and to export to Spain chemicals, including fertilisers, valued at $13 million.

German chemicals also figure prominently in trade agreements with Ecuador and Iceland and there is still keen buying interest in German potash salts.

Conversion to Fertilisers

Gewerkschaft Victor, owner of the Fischer-Tropsch plant at Castrop-Rauxel, for which the interim production permit expired at the end of 1949, has now made arrangements to employ the plant's 900 workers in the production of chemical fertilisers. The financial requirements for conversion to the manufacture of fertilisers have been met with the help of the North Rhine-Westphalian Government. Gewerkschaft Victor is to receive loans totalling Dm.4.7 million, of which Dm.2.7 million will be paid by March, 1951, to cover expenses incurred in the first 12 months.

Rheinische Kunstseide AG, Krefeld, reports that the total war damage, estimated at Rm.20 million, has been made good. Further plant modernisation and re-training of workers have, it is claimed, strengthened the competitive strength of the enterprise in the world market. About 5-10 per cent of the rayon and staple fibre output of this leading producer is being sold abroad, chiefly to Scandinavia, South and Central America. The demand for staple fibre still exceeds the company's productive capacity.

The pharmaceutical factory of Schering AG in West Berlin has benefited from the increased interest shown in Berlin economic life by the Allied authorities and the Federal Government in Bonn. The factory is now in full operation, and employment for its 1700 workers is assured for a considerable time, largely as a result of several big export orders.

The company's export business now accounts for 25-30 per cent of all sales, compared with 60 per cent before the war. Its best foreign markets are India, Australia and the Middle East. Sales in Eastern Germany, which would normally provide the main market for Schering products from Berlin, are still at a standstill. A new building, estimated to cost Dm.1.2 million, is being built, with ERP aid, on the company's Berlin premises.

New Insecticide

Farbenfabriken Bayer, Leverkusen, intends to place on the market a new insecticide, for which high effectiveness against the Colorado beetle is claimed. Hitherto known as E 838, it will be marketed under the trade name Potasan and is expected to be available in substantial quantities by next spring. It is said to be equally effective against other insects and larvae. Tests at the Central Biological Institute, Brunswick, were reportedly successful.

Commercial Chemical Trends in France

THE production figures of French chemical industry in February show outputs of 97,286 tons of sulphuric acid (111,700 tons in January); 10,820 tons of hydrochloric acid (little change); 8000 tons of calcium carbide (11,000); 53,044 tons of sodium bicarbonate (61,110); 19,313 tons of caustic soda (20,736); 5500 tons of copper sulphate (4150).

Comparative figures for fertilisers are as follows: 110,000 tons of compound fertiliser (105,000); 98,000 tons of superphosphates (95,000); 19,200 tons of anhydrous ammonia (21,964); 16,800 tons of nitrogenous fertilisers (19,170); 6000 tons of powdered phosphates (4500).

The Etablissments Kuhlmann is reorganising its factories to increase production, particularly of sulphuric acid. The new factories at Paimboeuf came into service last year. Study of a "flash roasting" plant at La Madeleine, part of a regional plan, has been completed.

On the expectation of the continued freeing of international trade, the French chemical industry is demanding fuller reciprocal measures, re-establishment of customs protection where free exchanges are still not available and revision of customs duties on the basis of home and foreign cost prices. The end of price limitation is also sought.

By the end of 1950, it is thought there will be few chemical materials whose entry will be restricted. The exceptions will be determined by consideration of the industry's modernisation plans, existence of over-production abroad, particularly in Germany, the high cost of power, and the national policy of encouraging agricultural production.

· PERSONAL ·

DR. E. W. TITTERTON, of the Atomic Research Establishment, Harwell, has been appointed to a chair of physics at the Australian National University. The professor was a member of a team working on the development of micro-wave radar devices during the war, and later distinguished himself in the advancement of physical technique when visiting the U.S.A. as one of the British nuclear research team. He is expected to go to Australia at the end of this year, and will work with Professor M. L. Oliphant in the Research School of Physical Sciences.

The Honorary Fellowship of the Institute of Petroleum, its highest class of membership, was awarded to MR. JAMES KEWLEY at the recent annual general meeting. Mr. Kewley, who is 70, has had long associations both with the oil industry, as an employee of 34 years' standing with the Shell organisation, and with the Institute of Petroleum, of which he has been vice-president and president. He was the Shell company's chief chemist during the 21 years preceding his retirement in 1940, in which position he was responsible not only for technical guidance on refinery matters and to the marketing areas, but also for the engagement and training of the large number of chemists and chemical engineers.

Two young Glasgow science graduates, ALFRED P. C. CUMMING and JAMES A. HORN, have been awarded the 1949 Newton Chambers Prize of £100, for their studies in connection with the burning of acetylene flames, research which was started as a result of a fatal accident in a coal mine. The award was made by the committee of the Sheffield, South Yorkshire and North Midland sections of the Royal Institute of Chemistry.

MR. W. J. SANDERS has been appointed general sales manager of Reads, Ltd., Liverpool, and its associated companies. He was formerly sales manager of the Metal Box Co., South London branch. He succeeds MR. LEONARD DODD, who is remaining with Reads, Ltd., as general sales adviser.

MR. R. G. BERCHEM, (Jeyes' Sanitary Compounds Co., Ltd.) is the chairman for the current year of the British Disinfectant Manufacturers' Association. MR. A. E. BERRY was, at the same meeting, elected vice-chairman and MR. VICTOR G. GIBBS hon. treasurer.

AIR COMMODORE SIR FRANK WHITTLE has agreed to act as a consultant to Power Jets (Research and Development), Ltd., in all matters relating to gas turbine except in the field of civil aviation. The appointment has the approval of the Board of British Overseas Airways Corporation, for which he will continue to act as honorary technical adviser on jet development. Power Jets is responsible for holding and exploiting patents resulting from Government research and development in the gas turbine field.

A photograph of MR. DEREK SPENCE, managing director of Peter Spence & Sons, Ltd., presenting a copy of "The Earliest Chemical Industry" to DR. BENJAMIN T. BROOKS, chemical consultant and chairman of the library committee of The Chemists' Club, New York, appears in the club's March bulletin (Vol. 3, No. 6). The book, published to mark the centenary, in 1946, of Peter Spence & Sons, Ltd., (THE CHEMICAL AGE *60*, 699), is an outstanding example of fine printing and colour reproduction.

MR. WILLIAM B. BIBBY, chairman of J. Bibby and Sons, Ltd., cattle food and soap manufacturers, Liverpool, was presented with a television set from the directors and employees at a dinner on April 21, to mark his retirement. He had served the company since 1898. Mrs. Bibby received a gift of jewellery. Mr. Bibby's successor as chairman is MR. H. PERCY BIBBY.

MR. L. O. KEKWICK was unanimously re-elected as chairman for a second year of the London Section of the Oil and Colour Chemists' Association at last week's annual meeting. The other principal officers, including the hon. secretary, MR. H. C. WORSDALL, were re-elected to serve for the current year.

LORD MCGOWAN, chairman of Imperial Chemical Industries, Ltd., was among those on whom the honorary degree of LL.D. was conferred at St. Andrews University on April 20.

OBITUARY

The death is announced of MR. H. J. G. WATKIS, general sales manager of a subsidiary company of Reads, Ltd., Liverpool, which he joined in May 1949 after his retirement from I.C.I., Ltd., London, where he was a buyer in the central purchasing department.

SIR GEORGE BEILBY AWARDS

Advancement of Chemistry

THE administrators of the Sir George Beilby Memorial Fund, representing the Institute of Metals, the Royal Institute of Chemistry and the Society of Chemical Industry, have decided to make three awards, each of 100 guineas, for 1949. These awards have been made to:

F. R. N. NABARRO, M.B.E., M.A., B.Sc. (Oxon.), in recognition of his application of mathematical methods to the elucidation of the mechanical properties of metals.

CHARLES ERIC RANSLEY, M.Sc., Ph.D. (Lond.), F.I.M., in recognition of his experimental contributions to knowledge of the behaviour of gases in metals.

KEBLE WATSON SYKES, M.A., B.Sc., D.Phil. (Oxon.), in recognition of his experimental contributions to the study of the combustion of carbon and its oxidation by steam.

Mr. Nabarro, born in London in 1916, was in 1938 a senior scholar of New College, Oxford, and later worked in the University of Bristol under Professor N. F. Mott. He published work on the effect of internal strains on precipitation in alloys, and on a simple theory of precipitation hardening. He carried out a great variety of studies, during the war, for the War Office and afterwards returned to Bristol as a Royal Society Warren Research Fellow in 1945. Since then he has worked principally on the dislocation theory of slip in metals.

Mr. Nabarro is a lecturer in metallurgy in the University of Birmingham and a research Fellow in metallurgy.

Dr. Ransley, educated at Wembley County School, graduated in chemistry at the University of London as an external student in 1942.

As a member of the metallurgical staff of the G.E.C. laboratories he was engaged mainly on problems connected with tungsten, molybdenum, nickel and other materials used in the manufacture of lamps and thermionic valves. In 1945 he became associated with the research laboratories of The British Aluminium Company at Gerrards Cross, Bucks., where he is in charge of a group working mainly on problems arising in the casting and fabrication of aluminium and its alloys.

Dr. Sykes has been closely identified with chemistry at Oxford University, where he obtained a first class in the Final Honours School of natural science (chemistry) and a distinction in crystallography.

(*continued at foot of next column*)

In 1942 he began work on wartime problems in the physical chemistry laboratory at Oxford under the supervision of Prof. Sir Cyril Hinshelwood. He held a Queen's College Taberdarship from 1943 to 1945, and an Imperial Chemical Industries Fellowship from 1945 to 1948. This work soon led to a fundamental investigation of the kinetics of the reactions of the steam-carbon system, which was carried on with a series of collaborators.

In 1948 Dr. Sykes went to University College, Swansea, as a lecturer in chemistry. He is studying, among other subjects, the kinetics of the reaction of carbon with compounds containing sulphur. Part of this work is being supported by the Ministry of Supply.

THE MELDOLA MEDALLIST

Study of High Explosives

ON the recommendation of the Council of the Royal Institute of Chemistry, the Society of Maccabaeans is to present the Meldola Medal for 1949 to Dr. Andrew John Blackford Robertson, in recognition of his work, before he was 30, on explosives and on the application of the mass spectrometer to the study of chemical reactions.

After graduating at Cambridge Dr. Robertson entered the Department of Colloid Science in 1941 as a member of Professor E. K. Rideal's team working on explosives, and studied their sensitiveness to heat.

Many high explosives were found to decompose quite smoothly, though rapidly, at elevated temperatures, and the kinetic features were studied. The actual transition between thermal decomposition and spontaneous explosion of a number of high explosives was directly examined.

Dr. Robertson was awarded the Henry Humphries Prize by St. John's College for this work, and in 1946 elected to a Fellowship. He continued experimental work under Professor Rideal at the Royal Institution on the catalytic pyrolysis of hydrocarbons, using a simple mass spectrometer as an analytical tool and for the direct detection of free radicals.

In 1948 he was appointed a junior research Fellow by the managers of the Royal Institution, and in 1949 to a senior studentship by the Commissioners for the Exhibition of 1951.

He is at present developing his work on the direct study of free radical reactions in the Davy Faraday Research Laboratory of the Royal Institution.

HOME

Reduction of Hard Soap Prices

From April 23, the maximum retail price of all brands of hard soap has been reduced by one halfpenny a pound, by an amendment of the Soap (Maximum Retail Prices) Order, 1947.

Price Control Removed

The Board of Trade has made an order freeing perfumes and toilet preparations from price control as from May 1. The Board notes that the prices of many of these goods have recently been reduced and there are now ample supplies.

Chemical Duty Exemptions

The Treasury has made an order under Section 10(5) of the Finance Act, 1926, exempting the following articles from Key Industry Duty for the period April 22-June 30, 1950: B. aminopropionic acid; ethyl sulphate (or ethyl ester); potassium guaiacolsulphonate; sodium fluosilicate; R. sorbitol; sorbitol, synthetic.

Wool Education Society

A new organisation to be known as the Wool Education Society has been set up by the International Wool Secretariat. It is to disseminate knowledge relating to wool and new developments in wool technology, publishing a quarterly journal *Wool Knowledge*. Meetings will be held, at first in London, but later in the Provinces.

Coal Production

Output of deep-mined coal in Britain last week rose by 1,205,100 tons to 4,161,100 tons. This compares with an average of 4,097,000 tons for the 13 full weeks before Easter and an average of 4,052,500 tons for the corresponding period last year. An increase of 83,300 tons in opencast output brought last week's total coal production to 4,420,700 tons. This was an increase of 1,288,400 tons over the previous week's total.

Higher Paper Prices

A general increase in the maximum prices of newsprint and most other types of paper and board took effect on April 24, associated with increases in the cost of imported woodpulp. The standard price of newsprint has been raised by £2 5s. per ton. Prices of other paper and board are increased by varying amounts according to the woodpulp content. Waste paper and other wast fibrous materials used in paper making will no longer be subject to price control or licensing.

£2 More for Lead

Following two reductions in price last month, the Ministry of Supply last week announced an increase in the U.K. cost of good soft pig lead by £2 a ton delivered, from £84 to £86 a ton.

Expanding Fish Oil Industry

Expansion of meal and oil reduction activity is proposed in Stornoway by the Herring Industry Board. It is planned to extend and modernise the plant to handle a much increased volume of herrings.

Prices of Refined Oils

The Minister of Food announces that no change will be made in the prices of refined oils and imported edible animal fats allocated to primary wholesalers and large trade users during the eight-week period ending June 17.

U.K. Light Metal Statistics

Ministry of Supply statistics relating to U.K. production, imports and consumption of light metals in November include the following (in long tons): Virgin aluminium: production 2303, imports 5901. Secondary aluminium: production 6850. Aluminium scrap arisings 7220, consumption 10,218. Aluminium fabrication: 17,842. Magnesium fabrication: 317.

Metal Prices Rise

The price of good ordinary zinc was increased by £4 from £91 10s. to £95 10s. a ton delivered, as from April 20. Prices of other grades varied accordingly. The zinc oxide manufacturers announced that from the same date, the price of zinc oxide in lots of not less than two tons, delivered, was increased by £3 10s. New prices for zinc oxide were: Red seal, £91; Green seal, £92 10s.; White seal, £93 10s.

Education in Chemistry

"I am well aware of the importance of an adequate supply of university graduates trained in chemistry," said the Chancellor of the Exchequer, replying in the House to questions about the provision of better chemistry training facilities at schools and universities. "The number of students taking honours courses in that subject has doubled since the war, and new laboratories are under construction or planned for erection in the near future at a number of universities. I am satisfied that the claims of the scientific departments are receiving due consideration from those responsible," he said.

Technical Publications

"SYMPOSIUM on Particle Size Analysis" and "A Problem in Chemical Engineering Design: The Manufacture of Mononitrotoluene" are two new publications recently issued by the Institution of Chemical Engineers.

* * *

"A CHEMIST looks at 1950" and "Outlook for Linseed" are features of the fourth annual edition of "The Spectrum," now available from the Society of British Paint Manufacturers, Ltd. This year all the content matter is material which has not already appeared in the monthly issues.

* * *

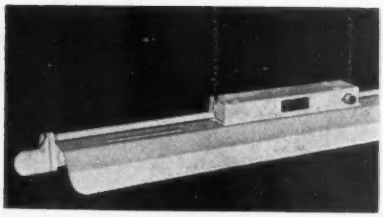
RECONSTRUCTION of the oil refinery at Dunkirk which is expected to be commissioned about the middle of next year is described in the April issue of "Naft Magazine" published by the Anglo-Iranian Oil Co., Ltd. Other features include: World Oil Production and Refining, second in a series of articles on the world's oil, and the construction of a large catalytic cracking plant and an ancillary equipment in Abadan, and the issue is well illustrated.

* * *

CHEMISTRY as a profession is discussed in an article "Should I Encourage My Son To Be A Chemist?" by Dr. A. W. Baldwin (Dyestuffs Division) in the April issue of the "I.C.I. Magazine" (Vol. 28, No. 162). The third of the series of articles on raw materials of the chemical industry deals with sulphur, air and water. There are, as usual, many excellent illustrations.

* * *

THE *Electrician* Blue Book Electrical Trades' Directory, the 68th edition of which has been published by Benn Brothers, Ltd. (£2 2s.), is recognised as the most comprehensive directory to the electrical and allied industries, their products and services and the professional and trading organisations associated with them. It contains some 50,000 references and its interest extends beyond electrical circles, embracing those who supply materials and equipment essential to the various branches of the electrical industry, and those concerned with the sale or use of electrical goods and apparatus, machinery and tools, motors, generating plant, vehicles, and so on.



[Courtesy of Crompton Parkinson, Ltd.

Dust and vapour-proof lighting fitting (A.V.1112) suitable for areas where moderate atmospheric concentrations of acid or alkaline vapour may be present. The ends are sealed by special silicone plastic washers

ANTIHISTAMINES SCHEDULED

Additions to the Poisons List

ANTIHISTAMINIC drugs are to be added to Part 1 of the Poisons List and included in the first and fourth schedules of the Poisons Rules. Preparations for external application will be exempt. This news is conveyed in a Board of Trade statement issued this week announcing that statutory instruments are about to be issued implementing this and a number of other recommendations by the Poisons Board.

The other changes foreshadowed are:

DFP (Di-isopropyl-fluorophosphonate) will be added to Part I of the Poisons List and included in the first and seventh schedules to the Poisons Rules.

Deca-, Hexa-, Penta-, etc. methonium iodide will be added to Part I of the Poisons List and included in the first and fourth schedules to the Poisons Rules. They will be listed as "polymethylene bistrimethyl ammonium salts."

Synthetic Drugs

The following drugs to which Part III of the Dangerous Drugs Act, 1920, is shortly to be applied will be added to Part I of the Poisons List and included in the first schedule to the Poisons Rules:—

Alphaprodine (α-4-propionoxy-4-phenyl-1: 3-dimethyl-4-piperidine) its salts; Betaprodine (β-4-propionoxy-4-phenyl-1: 3-dimethyl-4-piperidine) its salts; Hydroxypethidine (ethyl-4-*m* hydroxyphenyl -1- methylpiperidine-4-carboxylate) its salts; Isoamidone (6-dimethylamino-4: 4 diphenyl-5-methylhexan-3-one) its salts; Ketobemidone (4-propionyl-4-*m*-hydroxyphenyl-1 methylpiperdine) its salts; Methodl (6-dimethylamino-4 : 4 diphenylheptan-3-ol) its salts; Methadylacetate (6-dimethylamino-4: 4 diphenyl-3-hepylacetate) its salts.

· OVERSEAS ·

Dutch PVC

The production of polyvinyl chloride by the Bataafsche Petroleum Mij. (Royal Dutch Shell) at Pernis is reported to be likely soon to make Holland self-sufficient in that material. The target figure is some 2000 tons a year.

Methyl Alcohol Duty Free

Canada is authorising the importation, duty-free from all sources, of methyl alcohol to be used by manufacturers for the production of formaldehyde. The new regulation is current until June 30 next year.

Chemical Industry in Pakistan

The Advisory Committee on the Chemical Industry in Pakistan has recommended to the Government that its supply organisation should encourage the chemical industry by purchasing indigenous products. The Committee deplored the fact that the Government of Pakistan were placing orders outside Pakistan while the goods were available at home.

Pharmaceuticals and the Canadian Market

In chemicals and pharmaceuticals of various kinds there is no indication that competition from British sources will increase to any considerable degree, and it does not appear that special efforts are being made to expand this trade.—The U.S. *Foreign Commerce Weekly* (38 (12), 8) in a review of Britain's trade prospects in Canada.

Plastic Resin for Casting

Important reduction of finishing of metal castings is claimed for a new use of thermosetting plastic material to bond sand moulds, being employed by the Crown Casting Corporation, Boston, U.S.A. The process was originated, in collaboraton with the Union Carbide & Carbon Corporation, by Johannes Croning, of Hamburg, Germany.

Financing German Chemical Research

The need to provide a fuller financial support for research work in Germany was stressed at a recent meeting at Bury Castle of the Arbeitsgemeinschaft Chemische Industrie, which represents all the chemical associations of the Federal German Republic. Comparisons were drawn between expenditure on scientific research in Germany and other countries and the need of Government support from public funds was emphasised. The chemical companies were also asked to donate funds.

U.S. Atomic Laboratory Fire

Damage estimated at £53,500 was caused by a fire which destroyed a United States atomic energy building at Berkeley, California, on April 23. The fire was brought under control before it reached the University of California cyclotron.

Steelworks for Ceylon?

Dr. J. Durrer, a Swiss metallurgist, recently arrived in Ceylon to advise the Ministry of Industry and Industrial Research on suitable sites for the proposed iron and steel works. He has already started to survey the island's iron-ore deposits.

Manganese Discovery in Norway

Deposits of manganese-ore, discovered recently at Sauda in the vicinity of Stavanger, are considered potentially important because the Sauda Iron Works is at present using South African manganese ore. Access to the newly discovered deposits is reported to be difficult.

Dutch-Finnish Plastics Agreement

The Dutch dye and varnish producer, Pieter Schoen and Sons, Zaandam, has established an affiliate at Hangö (Finland), Suomen Väriteolisuus Oy, in conjunction with a Finnish firm. The Zaandam firm is to supply the new company with raw materials for plastics

Ceylon's Coconut Oil Surplus

Although Ceylon is unwilling to sell on contract her exportable surplus of coconut oil to the U.S.A., the latter has been invited to buy the oil in the free market. The reluctance of the Ceylon Government is stated to be chiefly due to the desire not to alienate her present customers—Pakistan, India, the United Kingdom and European countries. The American inquiry for coconut oil came as a surprise to the Ceylon trade, as almost the entire requirements of coconut oil in the U.S.A. has been met by the Philippines.

Artificial Colouring Prohibited

The Madras Government has published a regulation to prohibit the addition of artificial colouring matter to any fat or oil intended for sale. This includes hydrogenerated vegetable products, but excludes butter. The amendment also provides that no person shall add any artificial colouring matter to fats and oils in the raw state. It was reported in the Dominion Assembly, New Delhi, that the price of vegetable oil in Madras had risen 200 per cent in two months.

Next Week's Events

MONDAY, MAY 1

Society of Chemical Industry

London: School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, 6.30 p.m. Dr. E. B. Maxted: "Catalysis and the Poisoning of Catalysts."

The Chemical Society

Oxford: Physical Chemistry Laboratory, 8.15 p.m. Prof. A. R. Peters: "The Biochemistry of Fluoroacetate Poisoning and its Significance."

TUESDAY, MAY 2

The Institute of Metals

Swansea: University College, Metallurgical Department, Singleton Park, 6.30 p.m. Brigadier J. Gwynne Morgan: "Medical Aspects of Nickel Refining."

The Chemical Society

Exeter: Washington Singer Laboratories, 5 p.m. Prof. Brynmor Jones: "Some Aspects of Aromatic Substitution."

WEDNESDAY, MAY 3

North Western Fuel Luncheon Club

Manchester: Engineers' Club, 17 Albert Square, 12.45 p.m. Dr. F. Kind: "History and Outlook of Petroleum Refining."

THURSDAY, MAY 4

The Chemical Society

London: Royal Institution, Albemarle Street, W.1, 7.15 p.m. Tilden Lecture. Prof. F. S. Spring: "Recent Advances in the Chemistry of the Steroids."

Bangor: University College of North Wales, 5.30 p.m. (Joint meeting with college). Dr. E. J. Bowen: "Light-scattering and Chemistry."

Leeds Metallurgical Society

Leeds: University, Chemistry Department, 7 p.m. Annual general meeting, followed by junior members' papers.

The Royal Society

London: Burlington House, Piccadilly, W.1, 4.30 p.m. Prof. P. W. Bridgman: "Physics Above 20,000 Kg/cm.^{2}"

Royal Institute of Chemistry

Exeter: Washington Singer Laboratories, 3 p.m. Prof. R. P. Linstead: "Aspects of the Catalysed Addition and Transfer of Hydrogen in Organic Compounds."

FRIDAY, MAY 5

The Chemical Society

Southampton: Physics Department, University College, 5 p.m. Dr. S. H. Harper: "Recent Synthetical Developments in Pyrethrum Chemistry."

Birmingham: University, Edgbaston, 4.30 p.m. (with University Chemical Society). Prof. C. A. Coulson: "The Shape of a Chemical Bond."

Royal Institution

London: 21 Albemarle Street, W.1, 9 p.m. Prof. M. L. E. Oliphant: "The Generation and Use of Atomic Particles."

Royal Statistical Society

London: 2 Savoy Hill, W.C.2, 6 p.m. D. H. Read: "Experimental Designs and their Practical Application."

SATURDAY, MAY 6

Royal Institute of Chemistry

Swansea: Mond Nickel Co. works, Clydach. Works visit and discussion on "Safety and Hygiene in Industry."

USE OF ENERGY

British Association Programme

THE preliminary programme for this year's meeting of the British Association for the Advancement of Science, which will be held at Birmingham from August 30 to September 6, shows that the adaptation of energy to the service of man will be the main theme of the various discussions. Sir Harold Hartley's presidential address will be entitled "Man's Use of Energy."

In addition to the 13 sectional presidents' addresses, there will be three evening discourses which are always a popular feature of the meeting.

Dr. J. B. Conant, president of Harvard University and a former president of the American Association for the Advancement of Science, will present a paper on "An Experiment in the Study of Science by Non-Scientists."

For the first time in the association's history, an exhibition will be held in connection with this year's gathering. The display entitled "Man and Energy" has been arranged by the National Coal Board in collaboration with the British Gas Council, the British Electricity Authority and the Birmingham Municipal Museum.

To encourage the interest of younger scientific workers in the British Association, prizes to the value of 85 guineas for scientific essays are being awarded by *Endeavour*, the I.C.I. quarterly magazine. The association is also offering a prize of £10 for the best essay by an exhibitioner (guest member) on any aspect of the meeting.

Prices of British Chemical Products

Upward Trend in Material Costs

STEADY trading conditions have continued generally on the industrial chemicals market, with a satisfactory demand reported from home consumers both as regards delivery specifications and the placing of new business. The volume of export trade continues to be maintained. Owing to an increase in the controlled price of pig lead, dry white lead and dry red lead prices have been advanced by £1 15s. per ton and £2 per ton respectively. The new basis price for dry white lead is now £114 10s. per ton and for dry red lead £105 per ton. The chief feature of the coal tar products market is the advance in home prices as a result of the increased duty on hydrocarbon oils.

MANCHESTER.—Apart from the non-ferrous metal products, prices of which have fluctuated in sympathy with the recent movements in copper, lead and zinc, there has been little change in values on the Manchester chemical market. Contract deliveries to the cotton textile and other principal industrial outlets have been on a satisfactory scale and traders report a fair amount of replacement buying. There has also been a fair trade for shipment. Superphosphates, sulphate of ammonia and the compound fertilisers continue to meet a steady seasonal demand. In the by-products market, with one or two exceptions, including cresylic acid, a fairly good movement of supplies is reported.

GLASGOW.—A number of price increases have been notified in the Scottish market during the past week. These have been the direct increases as a result of the Budget in the price of white spirit, and there have also been delayed increases as a result of devaluation. It is understood that a number of other increases are likely. In general, the supply position has been satisfactory.

Price Changes

Rises: Benzol, copper carbonate, glycerin, lactic acid, litharge, naphtha, red lead, sodium sulphide, sulphuric acid, toluol, white lead, xylol, zinc oxide.

Reductions: Pitch, potassium permanganate.

General Chemicals

Acetic Acid.—Per ton: 80% technical, 1 ton, £61; 80% pure, 1 ton, £66; commercial glacial 1 ton £71; delivered buyers' premises in returnable barrels; in glass carboys, £7; demijohns, £11 extra.

Acetic Anhydride.—Ton lots d/d, £110 per ton.

Acetone.—Small lots: 5 gal. drums, £90 per ton; 10 gal. drums, £85 per ton. In 40/45 gal. drums less than 1 ton, £70 per ton; 1 to 9 tons, £69 per ton; 10 to 50 tons, £68 per ton; 50 tons and over, £67 per ton.

Alcohol, Industrial Absolute.—50,000 gal lots, d/d, 2s. 1d. per proof gallon; 500 gal. lots, d/d, 2s. 2½d. per proof ga

Alcohol, diacetone.—Small lots: 5 gal. drums, £133 per ton; 10 gal. drums, £128 per ton. In 40/45 gal. drums less than 1 ton, £113 per ton; 1 to 9 tons, £112 per ton; 10 to 50 tons, £111 per ton; 50 to 100 tons, £110 per ton; 100 tons and over, £109 per ton.

Alum.—Loose lump, £17 per ton, f.o.r. MANCHESTER: Ground, £17 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—2 cwt. non returnable drums; 1 ton lots £40 per ton.

Ammonium Carbonate.—1 ton lots: MANCHESTER: Powder, £52 d/d.

Ammonium Chloride. — Grey galvanising, £27 10s. per ton, in casks, ex wharf. Fine white 98%, £21 10s. to £22 10s. per ton. See also Salammoniac.

Ammonium Nitrate.—D/d, £18 to £20 per ton.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £78 and £76 10s. per ton.

Amyl Acetate.—In 10-ton lots, £171 10s. per ton.

Antimony Oxide.—£160 per ton.

Antimony Sulphide.—Golden, d/d in 5 cwt. lots, as to grade, etc., 1s. 9½d. to 2s. 4½d. per lb. Crimson, 2s. 6½d. to 3s. 3½d. per lb.

Arsenic.—Per ton, £38 5s. to £41 5s., ex store.

Barium Carbonate.—Precip., d/d; 2-ton lots, £27 5s. per ton, bag packing, ex works.

Barium Chloride.—£35 to £35 10s. per ton.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £29 10s. per ton d/d; 2-ton lots, £29 15s. per ton.

Bleaching Powder.—£25 15s. per ton in casks (1 ton lots).

Borax.—Per ton for ton lots, in free 140 lb. bags, carriage paid: Anhydrous, £54; in 1-cwt. bags, commercial, granular, £34 10s.; crystal, £37; powder, £38, extra fine powder, £39; B.P., granular, £44; crystal, £46; powder, £48-£48 10s.; extra fine powder £48.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granular, £62; crystal, £69; powder, £66 10s.; extra fine powder, £68 10s.; B.P., granular, £75 10s.; crystal, £81; powder, £78 10s.; extra fine powder, £80 10s.

Butyl Acetate BSS.—£149 10s. per ton, in 10-ton lots.

Butyl Alcohol BSS.—£140 10s. per ton, in 10-ton lots.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid £8 per ton, in 4 ton lots.

Charcoal, Lump.—£25 per ton, ex wharf. Granulated, £30 per ton.

Chlorine, Liquid.—£28 10s. per ton d/d in 16/17-cwt. drums (3-drum lots).

Chrometan.—Crystals, 6d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Cobalt Oxide.—Black, delivered, 8s. 5d. per lb.

Copper Carbonate.—MANCHESTER: 1s. 7¼d. per lb.

Copper Chloride.—(53 per cent), d/d, 1s. 11½d. per lb.

Copper Oxide. — Black, powdered, about 1s. 4½d. per lb.

Copper Nitrate.—(53 per cent), d/d, 1s. 10d. per lb.

Copper Sulphate.—£47 5s. per ton f.o.b., less 2%, in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £7 8s. per 1-2 cwt. lot, d/d.

Ethyl Acetate.—10 tons and upwards, d/d, £103 10s. per ton.

Formaldehyde.—£31 per ton in casks, according to quantity, d/d. MANCHESTER: £32.

Formic Acid.—85%, £66 to £67 10s. per ton, carriage paid.

Glycerin.—Chemically pure, double distilled 1260 s.g. 128s. per cwt. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; bulk carriage paid.

Hydrochloric Acid.—Spot, 7s. 6d to 8s 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—1s. 0½d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 18s. per lb. in cwt. lots.

Iron Sulphate.—F.o.r. works, £3 15s. to £4 per ton.

Lactic Acid.—Pale tech., £85 per ton; dark tech., £75 per ton ex works; barrels returnable.

Lead Acetate.—Nominal.

Lead Carbonate.—Nominal.

Lead Nitrate.—Nominal.

Lead, Red.—Basis prices per ton: Genuine dry red lead, £105, orange lead, £117. Ground in oil: red, £128, orange, £140.

Lead, White.—Basis prices: Dry English, in 8-cwt. casks, £114 10s. per ton, Ground in oil, English, under two tons, £135.

Lime Acetate.—Brown, ton lots, d/d, £18 to £20 per ton; grey, 80-82 per cent, ton lots, d/d. £22 to £25 per ton.

Litharge.—£105 per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £27.

Magnesium Carbonate.—Light, commercial, d/d, £70 per ton.

Magnesium Chloride.—Solid (ex wharf), £20 to £25 per ton.

Magnesium Oxide.—Light, commercial, d/d. £160 per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., lump, 7s. 4d.; smaller quantities dearer

Mercurous Chloride.—8s. to 9s. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methanol.—Pure synthetic, d/d, £28 to £38 per ton.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 3s. 7½d. per gal.; pyridinised 64° O.P. 100 gal., 3s. 8½d. per gal.

Nickel Sulphate.—F.o.r. works, 3s. 4d. per lb. (Nominal.)

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£128 to £133 per ton packed in free 5-cwt. casks.

Paraffin Wax.—From £61 10s. to £101 17s. 6d., according to grade for 1 ton lots.

Phosphoric Acid.—Technical (S.G. 1.500), ton lots, carriage paid, £61 per ton; B.P. (S.G.1.750), ton lots, carriage paid, 1s. 1d. per lb.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 9¾d. per lb.; ground, 10¾d. per lb., for not less than 6 cwt.; 1-cwt. lots, ½d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £64 per ton for 1-ton lots, ex store; hydrated, £58 for 1-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Chloride.—Industrial, 96 per cent, 6-ton lots, £16.10 per ton.

Potassium Iodide.—B.P., 11s. 1d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 7½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 6d. per lb.; technical, £6 13s. to £7 13s. per cwt.; according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—Dog-tooth crystals, £72 10s per ton; medium, £67 10s. per ton; fine white crystals, £21 10s. to £22 10s. per ton, in casks.

Salicylic Acid.—MANCHESTER: 1s. 11d. to 3s. 2d. per lb. d/d.

Soda Ash.—58% ex depôt or d/d, London station, £8 17s. 3d. to £10 14s. 6d. per ton.

Soda, Caustic. — Solid 76/77%; spot, £18 4s. per ton d/d.

Sodium Acetate.—£41-£55 per ton.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 8d. per lb.; anhydrous, 7¼d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £29 12s. 6d. per ton d/d in 2 ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2-cwt. free bags.

Sodium Chlorate.—£52 to £57 per ton.

Sodium Cyanide.—100 per cent basis, 8d. to 9d. per lb.

Sodium Fluoride.—D/d, £4 10s. per cwt.

Sodium Hyposulphite. — Pea crystals £23 2s. 6d. a ton; commercial, 1-ton lots, £21 12s. 6d. per ton carriage paid.

Sodium Iodide.—B.P., 16s. 9d. per lb, in cwt. lots.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums, £101 10s. ton.

Sodium Metasilicate.—£19 to £19 5s. per ton, d/d U.K. in ton lots.

Sodium Nitrate.—Chilean Industrial, 97-98 per cent, 6-ton lots, d/d station, £20 10s. per ton.

Sodium Nitrite.—£29 10s. per ton.

Sodium Percarbonate.—12½% available oxygen, £7 16s. 9d. per cwt. in 1-cwt. drums.

Sodium Phosphate.—Per ton d/d for ton lots: Di-sodium, crystalline, £32 10s., anhydrous, £65; tri-sodium, crystalline, £32 10s., anhydrous, £62.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Silicofluoride.—Ex store, nominal.

Sodium Sulphate (Glauber Salt).—£8 per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. £6 per ton d/d station in bulk. MANCHESTER: £6 10s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot. £24 15s per ton, d/d, in drums; broken, £25 5s. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £15 11s. 6d. to £17 16s. 6d. according to fineness.

Sulphuric Acid.—160° Tw., £6 16s. to £7 16s. per ton; 140° Tw., arsenic free £5 10s. per ton; 140° Tw., arsenious, £5 2s. 6d. per ton; Quotations naked at sellers' works.

Tartaric Acid.—Per cwt: 10 cwt. or more £8 10s.; 5 to 9 cwt. £8 12s.; 2 to 4 cwt. £8 14s.; 1 cwt. £8 16s.

Tin Oxide.—1-cwt. lots d/d £25 10s. (Nominal.)

Titanium Oxide.—Comm., ton lots, d/d, (56 lb. bags) £102 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d; white seal, £90; green seal, £89.; red seal, £87 10s.

Zinc Sulphate.—Nominal.

Rubber Chemicals

Antimony Sulphide.—Golden, 4s. to 5s. per lb. Crimson, 2s. 7½d. to 3s. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £11-£11 10s. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£56 to £59 per ton, according to quantity.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 10 5/16d. to 1s. 5¾d. per lb.; dark, 10½d. to 1s. per lb.

Lithopone.—30%, £36 15s. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£19 per ton.

Vermillion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, £10 8s.

Compound Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £10 14s. 6d. I.C.I. Special No. 1, £16 8s. 6d., rising by 2s. 6d. per ton per month to June, 1950. National No. 2, £10 18s. per ton.

"Nitro-Chalk."—£10 4s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean for 6-ton lots d/d nearest station, £11 per ton.

Coal-Tar Products

Benzol.—Per gal, ex works: 90's, 3s. 3d.; pure, 3s. 5½d.; nitration grade, 3s. 7½d.

Carbolic Acid.—Crystals, 10¾d. to 1s. 0½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 10¾d. to 1s. 0½d. per lb., d/d crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 6½d. to 9¾d. per gal., according to quality, f.o.r. maker's works. MANCHESTER: 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 98%, 3s. 9d. per gal.; 99%, 3s. 1d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 3s. 11d. per gal.

Naphtha.—Solvent, 90/160°, 3s. 7d. per gal. for 1000-gal. lots; heavy, 90/190°, 3s. 1d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £8 1s. to £12 13s. per ton according to m.p.; hot-pressed, £14 15s. to £15 14s. per ton, in bulk ex works; purified crystals, £28 to £43 5s. per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 90s. per ton f.o.r. suppliers' works; export trade, £6 to £7 per ton f.o.b. suppliers' port. MANCHESTER: £5 10s. f.o.r.

Pyridine.—90/160°, 21s. 6d. MANCHESTER: 19s. to 22s. per gal.

Toluol—Pure, 3s. 11d. per gal.; 90's, 3s. 1d. per gal. MANCHESTER: Pure, 3s. 2d. per gal. naked.

Xylol.—For 1000-gal. lots, 4s. 0½d. to 4s. 3d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d to 5s. 6d. per gal.; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediates and Dyes (Prices Nominal)

m-**Cresol** 98/100%.—Nominal.

o-**Cresol** 30/31° C.—Nominal.

p-**Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb.; 66/68° C., 1s.

p-**Nitraniline.**—2s. 11d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—1s. 2d. per lb.; P.G. 1s. 0½d. per lb.

o-**Toluidine.**—1s. per lb., in 8/10-cwt. drums, drums extra.

p-**Toluidine.**—2s. 2d. per lb., in casks.

m-**Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON: April 25. The prices of all refined oils and fats remain unchanged during the eight-week period ending on May 17. The prices of all unrefined oils and fats remain unchanged during the five-week period ending on May 6.

Chemical and Allied Stocks and Shares

RUBBER shares have been an active feature of the Stock Market on the sharp advance in the price of the natural product, which at 1s. 9⅝d. per lb. is the highest since 1926, and several pence above the level of the synthetic rubber in the U.S.

Further improvement in British Funds was due to continued expectations that the big British Electricity issue is pending, and to good market estimates of the possible terms. The continued request to limit dividends has prevented industrial shares attracting more than moderate attention.

Movements in chemical and allied shares did not exceed more than a few pence in most cases. Imperial Chemical were 42s. 7½d., Monsanto 48s. and Albright & Wilson remained steady at 28s. 9d. awaiting the results. Boake Roberts were 26s. and Laporte Chemicals 5s. units 9s. 6d. Elsewhere, Brotherton were 19s. 3d., Amber Chemical 4s. 9d., Bowman Chemical 5s. 3d., F. W. Berk 14s. 3d. and Pest Control 5s. shares were 7s. 9d. and Fisons 21s. 9d. Among preference shares, L. B. Holliday 4½ per cents were 19s. 9d., British Chemicals & Biologicals 4 per cents 16s. 9d. xd., and W. J. Bush 5 per cents 22s. 3d.

Borax Consolidated were firm at 51s. 6d., British Aluminium 39s. 9d., and British Glues & Chemicals 4s. units further strengthened to 21s. and British Oxygen at 93s. were steady, awaiting the annual meeting and news of the company's capital requirements. United Molasses eased slightly to 41s., Turner & Newall were 77s. 9d. and Associated Cement firm at 79s. 6d. on the results. Movements in shares of companies connected with plastics were mostly small. British Xylonite changed hands around 66s. 10½d., De La Rue were 20s. and Kleemann 1s. shares 8s. 3d. The 4s. units of the Distillers Co. have been 17s. 6d.

Iron and Steels were generally firmer, United Steel at 24s. 6d., at which there is a yield of 6½ per cent, while Hadfields, at 25s., return nearly 6¾ per cent. Guest Keen have risen to 42s. 3d. on the good results anounced by Guest Keen Baldwins. Results of Guest Keen itself are due shortly. Elsewhere, Powell Duffryn were steady at 29s. and Staveley firmer at 80s., as were Babcock & Wilcox at 58s. 3d.

Triplex Glass held their recent improvement to 18s. 9d. at which these 10s. shares yield 5½ per cent on the basis of last year's 10 per cent dividend. United Glass Bottle were 69s. 4½d. and General Refractories 22s. 3d.

Glaxo Laboratories have remained at 47s. 9d., British Drug 5s. shares were 6s. 6d., with Boots Drug slightly easier at 46s. 3d. and Sangers 23s. Amalgamated Metal at 19s. 10½d. have been steady; there are continued hopes in the City that other metals in addition to tin will be freed before the end of the year and dealt in on the London Metal Exchange.

Oil shares have been uncertain. Shell were lower at 61s. 3d. attributed partly to U.S. selling. Anglo-Iranian were lower at slightly under £6¾, and Trinidad Leaseholds eased to 21s. 6d. Nevertheless, it is assumed in many quarters that, as far as home business is concerned, the effect of the increased petrol ration will probably more than offset the higher petrol tax.

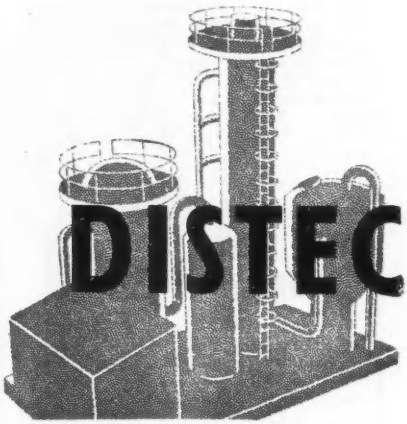
Vast French Gypsum Resources

THE increasing importance of gypsum for the dual purpose of cement and sulphuric acid manufacture lends interest to the large supplies of this mineral in France. V. Charrin has recently described these formations, emphasised their economic value and indicated their nature and origin.

Investigation of the gypsum-bearing Trias in Lorraine and elsewhere has revealed very extensive deposits closely resembling the anhydrite form. (*Chim. et Ind.*, 1950, *63*, 308-310.) Some of these in the south, *e.g.*, in Devoluy, such as the Suzette formation, are particularly rich in gypsum. One at Lazer is very extensive and contains some tens of millions of tons, and easily worked. Sulphur content is 56-57 per cent. In l'Ariège, at Bédeilhac, are the gypsum deposits that supply the works of Office Nat. de l'Azote of Toulouse. For ammonium sulphate manufacture, of which the annual production is 100,000 tons. Gypsum supplies in France are in fact practically inexhaustible. The Tertiary formations in the Paris region, though well known and extensively worked, are alone said to be almost limitless. There are further vast deposits in the Aix-en-Provence basin.

More Sicilian Sulphur

Italian exports of Sicilian sulphur in December last reached the exceptionally high level of 13,935 metric tons, more than twice as much as in December 1948.



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Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

SYNTICS, LTD., London, S.W., manufacturers and dealers in plastics, etc. (M., 29/4/50.) March 24, deb., to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; general charge. *—. October 19, 1949.

TURKDEAN DEVELOPMENT, LTD., Cheltenham, manufacturers of chemicals and insecticides. (M., 29/4/50.) March 17, £5000 deb., to G. L. Pilkington; general charge.

UNIVERSAL CHEMICAL PRODUCTS, LTD., Birmingham. (M., 29/4/50.) March 25, deb., to Lloyds Bank, Ltd., securing all moneys due or to become due to the Bank; general charge. *Nil. Oct. 14, 1948.

Company News

Distillers Co., Ltd.

The directors of the Distillers Co., Ltd., anonunce that they have declared a dividend on the preference stock for the six months ended March 31, at the rate of 3 per cent less income tax, payable on May 15, to stockholders on the register at April 20.

New Registrations

Bottogas, Ltd.

Private company. (481,121). Capital £300,000. To acquire and hold shares, stocks, debentures, etc. Power is also taken to carry on business as producers, refiners and storers of butane, propane, coal gas and inflammable substances and materials, petroleum and petroleum products, etc. Solicitors: Slaughter & May, 18 Austin Friars, E.C.2.

Manufacturers Supply Co., Wickham, Ltd.

Private company. (481,202). Capital £1000. To acquire the business of manufacturers of scientific instruments, pressed and blown glassware, vacuum containers and technical consultants, now carried on by F. A. Plummer and H. G. Flood at 19 Glebe Way, West Wickham, Kent, as "Manufacturers Supply Co." Directors: H. G. Flood, 19 Glebe Way, West Wickham, Kent; and L. A. Eley, 65 Wickham Chase, West Wickham, Kent. Reg. office: 19 Glebe Way, West Wickham, Kent.

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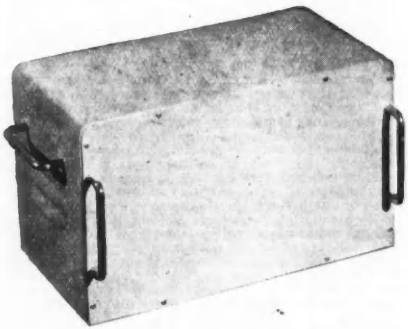

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Form of application for the position and further particulars may be obtained from **The Principal, College of Technology, Belfast,** with whom applications must be lodged not later than Wednesday, 31st May, 1950.

J. STUART HAWNT,
Director of Education.
Belfast.

MANAGER/CHEMIST required for British-owned Edible Oil Refinery in East African coast area. Single man preferred. Good terms, with overseas leave offered. Send full particulars to Box No. C.A. 2910, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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No. 201 One **DITTO.**

No. 202 One **DITTO.**

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No. 210 One **HORIZONTAL MIXER** as above.

No. 211 One **HORIZONTAL MIXER** as above.

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No. 213 One **HORIZONTAL MIXER** as above.

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